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Exploring Pregnant Women's Perceptions and Decision Making of Household Chemicals: Phthalates as a Model

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A thesis submitted in partial fulfillment of the requirements for the degree in Master of Science

EXPLORING PREGNANT WOMEN'S PERCEPTIONS AND DECISION MAKING REGARDING HOUSEHOLD CHEMICALS: PHTHALATES AS A MODEL

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ABSTRACT AND KEYWORDS

Recent research has identified a group of plasticizers known as phthalates as potential anti-androgens and a risk to developing male fetuses. A constructivist grounded theory study was used to understand pregnant women and obstetrical care providers' perceptions of phthalates. Twenty-three pregnant women and twelve obstetrical care providers (Obstetricians, Family Physicians, and Midwives) from Southwestern Ontario participated in semi-structured interviews. Pregnant women and clinicians had little knowledge regarding phthalates and the potential associated risks. Women felt that knowledge of these risks would be important to prenatal counselling while clinicians required more evidence. Two separate but related models emerged from the data depicting salient relationships in pregnancy and women's decision making processes. Relational autonomy theory was used as a conceptual framework to better understand the models. More efforts are needed to educate pregnant women about the risk of phthalates and facilitate decision making in pregnancy.

Keywords: constructivist grounded theory, pregnant women, risk, phthalates, motherhood, medicalization, relational autonomy, and health

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1 INTRODUCTION

1.1 Background and Significance

The right to a healthy pregnancy is an ideal well established in social values and law (Cook & Dickens, 2002). Determining what constitutes a healthy pregnancy is constantly debated and shaped by one's historical, social, economic, and political contexts (Maienschein & Robert, 2010; Mykitiuk & Nisker, 2010). Historically, it was considered woman's work to know what was best for the health of herself and her family (Tardy, 2000). Since well into 19th century, science has developed to a point that reproductive health, pregnancy, and child rearing has fallen out of the private sphere and into the public domain of experts. Pregnancy has come to be conceptualized as medically problematic with pregnant women considered at risk and in need of monitoring (Jordan & Murphy, 2009; Lupton, 1999; MacKenzie Bryres & van Teijlingen, 2010). For example, of the 333,000 babies born in Canada each year, 99% of those births occur in hospital and 75% involve some medical procedure (Parry, 2008). Furthermore, over 22% of deliveries are caesarean sections. These statistics point to the prominence of medical and expert based understandings of risk and pregnancy.

The effect of the medicalization of pregnancy on women has been well-studied. Specifically, this literature has shown how the medicalization of motherhood has placed health providers in an active role and pregnant women as passive recipients of health services (Rothman, 2000). For example, a recent study exploring the perceptions and experiences of pregnant women over 40 found that, despite feelings and perceptions to the contrary, women were more likely to consent to medical interventions as a result of recommendation made by their family and obstetrical clinicians (Kelha, 2009). These

results point to the increasing dominance of expert discourses of risk in pregnancy and the diminishing role of women's own understandings and experiences (Jordan & Murphy, 2009; Lupton, 1999). Other studies have shown that women's personal experiences of pregnancy, birth, and motherhood help negate the dominance of medical discourses of future pregnancies and highlight the value of personal understandings (Lupton, 1999; Miller, 2007; Murphy, 2000).

Despite the increase of risk based approaches and the medicalization of pregnancy, what has remained is the expectation for women to take the necessary steps to ensure the health of her family by engaging in risk reducing behaviours (Miller, 2005; Murphy, 2000; Tardy, 2000). Women must negotiate a myriad of information sources including her intuitions, family practices, expert advice, and messages from the media. There are real consequences if a woman is not perceived by society as tirelessly pursuing the health of herself and her family (Lupton, 1999). Particularly, women are in moral danger of being labelled as a bad mother (Altman et al., 2008; Murphy, 2000). This can be potentially damaging to a woman's sense of self, motherhood, and agency (Karpin, 2010; Lupton, 1999). Tardy (2000) observes: "If the mother fails, if her child becomes ill, then not only does she hold herself responsible but others hold her responsible as well" (p.445).

Environmental risks, especially chemical exposures found in household products, pose unique challenges for women (Steinemann, 2004). The ubiquitous nature of these chemicals along with the complex (Briggs, 2008) ways they interact make it difficult for concerned individuals to minimize their exposure to these exposures (Altman, 2008). Moreover, given that women often make purchases for the household (OECD, 2008) and

are generally responsible for more environmentally oriented work in the household (Hunter, Hatch, & Johnson, 2004) it is fair to expect women to experience an increased burden of reducing exposure to these risks.

Phthalates, diesters of 1,2-benzedicarboxylic phthalic acid, exemplify the types of household chemical risks that pose challenges to women during pregnancy. Phthalates are used in a wide range of commercial and household products such as insulation, polyvinyl chloride, children's toys, food containers, time-released pharmaceuticals, and personal care products (EPA, 2009). A majority of the current understanding regarding phthalates is based on animal models. Studies primarily based on mice and rats show that phthalates can have a wide range of effects. Phthalates have been known to affect the Wolffian duct and prostate (Barlow & Foster, 2003), and cause hypospadias, and cryptorchidism (Sharpe, 2003). All of these abnormalities are analogous with testicular dysgenesis syndrome (TDS) in male newborns, a medical phenomenon currently being studied.

Relative to the knowledge of the effects of phthalates in animal models, the reproductive developmental effects of phthalates in humans has been significantly understudied. Most of the studies have examined the anti-androgenic effects in newborn males, such as reduced penile size, shorter anogenital distance, and cryptorchidism (Swan, 2008, as cited in Meeks et al., 2009). Other effects include shorter gestational age at birth (Latini et al., 2003). The majority of these studies have found correlations and not causations (Foster, 2006). In summary, little is known about the true health effects of phthalates (Swan, 2008).

The ubiquitous nature of phthalates (Halden, 2010), detectable presence in humans (Koch & Calaft, 2009), and potential estrogenic effects (Meeker, Sathyanarayana, &

Swan, 2009) have made phthalates chemicals of high priority for public health officials and regulating bodies (EPA, 2009; Health Canada, 2011; Kamrin, 2009). Various regulatory initiatives have been undertaken nationally and internationally to limit phthalate exposures primarily in children's toys (Australian Government, 2011; Canada Gazette, 2010; European Parliament, 2005; United States Congress, 2008). Unfortunately, no regulation fully addresses all meaningful sources of phthalate exposure and protects pregnant women's exposures (Kamrin, 2009).

The media has been running stories about the risks of phthalates and exposing women to knowledge of these risks (Mackendrick, 2010). For example, the Woman's magazine "Glamour" (2011) published an article identifying phthalates as one of "the new threats to women's health." Recent media attention regarding the risk of phthalates suggests that knowledge of these risks have begun to enter into the public consciousness and shape individual's perceptions (Arnoldi, 2010; Mackendrick, 2010). This also suggests that phthalates could become a health concern that obstetrical care providers will have to address in their practice and be able to discuss meaningfully with women.

A considerable amount of research has focused on understanding women's perceptions of risk and how these perceptions affect subsequent behaviour and decision making (Jordan & Murphy, 2009; MacKenzie Bryres & van Teijlingen, 2010). This work suggests that pregnant women's perceptions of risk are influenced by various factors including socioeconomic status, culture, and education (Miller, 2005). Most of this work deals with tangible risks such as accessing prenatal care (Chapman, 2003), intentions to breast feed (Murphy, 2000), taking medications during pregnancy (Nordeng, Ystrom, & Einarson, 2010), vaccinations (Tucker Edmonds, Coleman, Armstrong, & Shea, 2011)

and prenatal screening (Lupton, 1999). Little research has been conducted on understanding women's experiences with household chemical risks such as phthalates and has been identified as an area in need of research (Mackenzie, 2010). It is this gap in understanding that provides the foundation of this thesis and research project.

1.2 Study Purpose

Given the recent research, policy and media focuses on phthalates, this study was conducted to explore the understandings of pregnant women and clinicians who provide prenatal care, regarding information on the risk of exposure to phthalates and endocrine-disrupting household products in pregnancy. The main question and sub-questions of this study were:

How do pregnant women and clinicians perceive and understand the risk of phthalates and other household chemicals during pregnancy?

a. How do pregnant women understand and subsequently negotiate household chemicals risks such as phthalates?
b. Where do women receive information regarding household chemical risks in pregnancy?
c. How do women engage in making decisions regarding household chemical risks in pregnancy?
d. How do health care providers understand phthalates and how does that affect the care they provide pregnant women?

By developing an empirical understanding of these questions, this study will address a current gap in the risk and motherhood literature and provide a conceptual framework for healthcare professionals and policy makers to consider for future care and policies.

1.3 Declaration of Self

This study was a part of a multi-center research project funded by the Canadian Institute of Health Research (CIHR). As a whole, the project is interested in studying phthalates from multiple disciplines including chemical engineering, cell biology, animal toxicology, and sociology (Robaire, 2009). My work was a part of the Ethical, Legal, and Social (ELS) team led by Dr. Jeff Nisker, Dr. Dayna Scott, and Ms. Roxanne Mykitiuk. All three principal investigators have extensive experience working as colleagues, supervising students, and conducting qualitative research. Other students on the ELS team came from diverse academic backgrounds including public health, philosophy, and medicine. The interdisciplinary nature of the research team assembled was well equipped to handle the multi-faceted nature of this research.

My personal experiences were also particularly suited for this research project. My undergraduate work in Health Sciences at Western University has offered me a chance to study a wide range of disciplines and research methodologies. Studying disciplines such as biochemistry and organic chemistry have prepared me to deal with the science related to phthalates. My experiences studying quality of life, professional ethics, and health promotion have also made me privy to the social aspects of health, and how our social environments can influence decision making and health outcomes. Finally, I have had previous experience in both quantitative and qualitative research. These experiences have developed my appreciation of the insights and limitations various research methods offer and how best to apply them. Taken cumulatively, I believe I have a unique skill set that has allowed me to develop a competent understanding of the issues at hand as well as bring unique insight to the study.

1.4 Thesis Outline

Following this introductory chapter, Chapter Two of this thesis will provide a review of current literature regarding risk, pregnancy, and motherhood and situate it within the context of phthalates. Chapter Three will provide a review of the methodology used to understand pregnant women and clinician's understanding of household chemical risks in pregnancy as well as a detailed discussion of the specific methods to collect and analyze the data. Chapter Four reviews the findings of the study and how the two models emerged from the analysis. Chapter Five discusses how the findings advance current understanding of risk in pregnancy and discusses future implications for practice, policy development and future research.

2 LITERATURE REVIEW

2.1 Introduction

The following literature review explores the social issues of household chemical risk in the context of phthalates. A thorough review of the scientific literature, as well as a study of the various regulatory and media responses to phthalates will demonstrate how phthalates exemplify the type of household chemical risks pregnant women are exposed to in their households and how regulatory bodies and the media frame these risks. Moreover, through a review of the literature regarding women's experiences and perceptions of household chemical risks during pregnancy, a rationale for why further study is needed in this area will be outlined. A brief description of the study conducted to address this question will conclude the chapter.

2.2 Phthalates

Since 1600 BC, natural rubbers have been manipulated by humans for the benefit of society (Andrady and Neal, 2009; Halden, 2010). Since then, human uses for plastic have steadily increased. In the first 50 years of the 20th century, humans began synthesizing their own plastics, through a process involving chemically bonding the same molecule (known as a monomer) to itself hundreds of times over (becoming a polymer) (Halden, 2010). Today, plastics are rarely synthesized as a pure polymer. Additives, known as plasticizers, are synthesized along with the polymer to achieve a wide range of effects including strength, softening, flame retarding, and degradation prevention. Phthalates are the most common group of plasticizers used, representing over 70% of the plasticizer market (Halden, 2010).

Over 25 various phthalates are used in commercial applications, each one offering unique qualities to the plastic they are incorporated into as a function of the length of their side chains. The eight most common phthalates are: dibutyl phthalate (DBP), Diisobutyl phthalate (DIBP), Butyl benzyl phthalate (BBP), Di-*n*-pently phthalate (DnPP), Di(2-ethylhexyl) phthalate (DEHP), Di-*n*-octyl phthalate, Diisononyl phthalate (DINP), 1,2-diisodecyl ester (DIDP) (EPA, 2009; Halden, 2010; Latini, Scoditti, Verrotti, De Felice, & Massaro, 2008).

2.2.1 *Uses and Exposures*

Over 18 billion pounds of phthalates are produced worldwide with over two million tons of DEHP, one of the most common and likely harmful phthalates, produced annually (Latini et al., 2008). Their primary application is as plastic softeners in polyvinyl chloride (PVC) to increase flexibility and malleability (EPA, 2009). Examples include industrial plastics, electric wiring, vinyl tiles, paints, medical devices, and children's toys. The amount of phthalates found in the product influences the different properties they impart. Phthalates can comprise up to 80% of the soft PVC in medical devices (Halden, 2010). Low molecular weight phthalates are used to bind fragrances in personal care products, such as sun screen, lotions, and perfumes (Meeker, Sathyanarayana, & Swan, 2009). They can also be found on coatings of time released pharmaceuticals such as mesalamine, an anti-inflammatory drug; and didenosine, an antiretroviral drug (Hernandez-Diaz, Mitchell, Kelley, Calafat, & Hauser, 2008).

Since phthalates are not chemically bound to products they can easily leach out into the environment and into human systems (Koch & Calaft, 2009; Latini et al., 2008). Common routes of exposure include ingestion, inhalation, intravenous exposures, and

dermal contact (Talsness, Andrade, Kuriyama, Taylor, & vom Saal, 2009). Phthalates are quickly metabolized in the body and excreted in urine and faeces (Meeker et al., 2009; Koch & Calaft, 2009; Samandar, Silva, Reidy, Needham, & Calaft, 2009). Accordingly, exposure estimates are best made via phthalate monoesters analysis (phthalate metabolites) in the urine (Hogberg et al., 2008). Due to their quick metabolise, the health risks of phthalates are not one of cumulative exposures as they are for other well-known environmental chemicals such as polybrominated diphenyl ethers (flame retarding plasticizers) and dicholorodiphenylthrichloroethane (DDT) (a banned fertilizer) (Meeker et al., 2009). Instead, due to the ubiquitous nature of phthalates along with different phthalates in the environment, health risks are more likely to come from continuous exposure to multiple phthalates at once (Samandar et al., 2009; Silva et al., 2008; Swan, 2008).

Phthalates can be found in various quantities in all human beings. They can be detected in blood serum, seminal fluid, amniotic fluid, breast milk, and saliva (Latini et al., 2003; Latini et al., 2008). Exposure to DEHP is the highest amongst the general population (Latini et al., 2008). Some research has suggested that certain social groups can experience greater phthalate body burdens. For example, with respect to body weight, children can experience exposures to DEHP, DBP, and BBP twice as high as adults (Latini et al., 2008). Urine concentrations of mono-ethylhexyl phthalate (MEHP) and mono-hexyl phthalate (MHP) (metabolites of DEHP) are higher in Afro-American and Hispanic American populations than Caucasians (Center for Disease Control and Prevention [CDC], 2009). No explanation was given to explain this difference. Due to the high amounts of DEHP in medical equipment, nurses and plastic factory employees can

be exposed to up to 700 µg/kg/day of DEHP (Kamrin, 2009). This figure significantly exceeds the EPA's reference dose of 20 µg/kg/day (a figure estimating the maximum daily exposure considered to be safe) as well as the tolerable daily intake recommended by the European Union (EU) of 37 µg/kg/day (Kamrin, 2009). It is reasonable to suspect that women in other occupations may experience more exposure to phthalates than their male counterparts due to the gendered division of labour (Arbuckle, 2006). One reason for this has to do with safety equipment being designed for men. Accordingly, women are poorly protected from potential occupational hazards. For example, one study found that three types of commonly used respirators provided less protection for women than men (Han, 2000) Notably, women of reproductive age were shown to have significantly higher levels of the metabolite mono-butyl phthalate (MBP) in their urine than other age and gender groups (Blount et al., 2000).

2.2.2 *Methodological Issues*

It is important to note two specific difficulties dealing with the quantification of exposure assessments of phthalates. Firstly, there is the issue known as the phthalate bank problem (Koch & Calaft, 2009). Essentially, phthalates are so ubiquitous that even trace amounts are found in the equipment used to test human levels. Consequently, it becomes difficult to determine whether or not studies are providing accurate phthalate measures. This problem limited early human studies to highly exposed populations (Ching et al., 1981; Dirven et al., 1993; Pollack, Buchanan, Slaughter, Kohli, & Shen 1985) or produced ambiguous results (Colon, Caro, Bourdony, & Rosari, 2000; McKee 2004). Research suggests that this problem persists even after extensive cleaning of laboratory equipment (Koch & Calaft, 2009).

The second problem revolves around the two most common methodologies researchers use to quantify and estimate daily exposures to phthalates: environmental and behavioural analysis, and biomonitoring. Environmental and behavioural analysis provides indirect exposure measures based on surveys of behavioural data, knowledge of chemicals in various media, and estimating human contact (Koch & Calaft, 2009). This type of analysis is often used as it provides data for all age groups, and can estimate timing and duration of exposures (Kamrin, 2009). However, it is limited by the lack of direct measurement and the amount of assumptions necessary in reporting estimates.

Conversely, biomonitoring provides direct measures of phthalate metabolites found in humans (Koch & Calaft, 2009). However, this method has limitations as it can only provide a snapshot of a person's phthalate burden which can fluctuate over the course of a few days (Meeker et al. 2009). Moreover, since little is known regarding how phthalates are metabolised in the body, deciding which phthalate metabolite is the most appropriate analyte is a challenge facing researchers (Kamrin, 2009). Combining environmental and behavioural analysis biomonitoring methodologies would help give researchers more confidence in their estimates. However, one must still interpret the findings of these studies with caution.

In summary, phthalates are ubiquitous in the environment (Halden, 2010) and have been shown to be found in humans (CDC, 2009). Moreover, there seems to be a particular burden on children (EPA 2009) and women (Blount et al., 2000). The next question this discussion will address is: What effects, if any, do phthalates have in humans? To do this, we will first review the work that has been conducted on animal models.

2.2.3 *Animal Studies*

A majority of the knowledge regarding the effects of phthalates in biological systems comes from research conducted on animal models (Meeker et al., 2009). Animal research allows researchers to maximize control exposures and draw causative conclusions (Kamrin, 2009). Phthalates have been shown to have a wide range of effects in animals. At high doses not relevant to humans, phthalates have been shown to have induced liver and kidney tumors as well as adverse effects to the reproductive system (Howeshell et al., 2007). At lower, more relevant doses, phthalates have been established as endocrine disruptors (EDs) (Yanagisawa, et al., 2008; Howdeshell *et al.,* 2007; Wilson, Blystone, Hotchkiss, Rider, & Gray, 2008; Meeker *et al.,* 2009).

Schug, Janesick, Blumberg, and Heindel (2011) define EDs as:

> Synthetic chemicals that were originally designed for a specific action such as a pesticide, plasticizer, or solvent, but now have been found to have a side effect that when absorbed into the body causes them to either mimic or block hormones and disrupt the body's normal functions. This disruption can occur by altering normal hormone levels, inhibiting or stimulating the production and metabolism of hormones, or changing the way hormones travel through the body, thus affecting the functions that these hormones control. (pp. 204-205)

Phthalates are hypothesized to exert their endocrine disrupting effects through broader endocrine regulations that include the activation of certain metabolic pathways (Lague & Tremblay, 2008; Mahood, et al*.,* 2006; Wilson *et al.,* 2008; Scott et al., 2008). The specific mechanism of action that phthalates exhibit is still largely unknown (Talsness et al., 2009).

Early work on phthalates on adult rats and mice suggest that they may affect male and female reproductive systems (Meeker et al., 2009). However, this work is still in its infancy and may not be particularly relevant to humans (EPA, 2009). Of particular concern are the effects phthalates have on the developing reproductive system of the male fetus in pregnant females, especially during the sensitive stage of sexual differentiation (Hutchison et al., 2008; Lague & Tremblay, 2008; Scott al., 2008; Talsness et al., 2009). This is because sexual differentiation is a highly conserved process amongst mammals (EPA, 2009; Foster, 2006).

Results of these studies have found that exposure to phthalates can lead to impaired development (agenesis) of the epididymis and the gubernaculum, both important organs of the male reproductive system (Howdeshell et al. 2007; Wilson et al., 2008). Studies have also noted the impairment of Sertoli cell maturation – cells which nurture developing sperm cells (Culty et al., 2008; Hutchinson et al., 2008; Lague & Tremblay, 2008; Mylchreest, Sar, Wallace, Foster, 2002; Wilson et al., 2008).

Notably, phthalates have also been shown to decrease Leydig cell function (cells found in the testes responsible for releasing sex hormones) (Latini et al., 2008; Talsness et al., 2009). Specific outcomes observed include a reduction in testosterone (the primary male sex hormone) (Culty et al., 2008; Scott et al., 2007; Wilson et al., 2008) as well as a reduction in a protein known as insulin-like hormone 3 (INSL3) (Culty et al., 2008; Foster, 2006; Gray et al., 2006; Howdeshell et al., 2007; Lague & Tremblay, 2008; Wilson et al., 2008). The effects of altered Leydig cell activity culminate in other adverse and observable outcomes to the male reproductive system, such as cryptorchidism, a condition defined by undescended testes; hypospadias, which is abnormal urethral

opening; and impaired spermatogenesis (Culty et al., 2008; Fisher, Macpherson, Marchetti, & Sharpe, 2003; Hutchinson et al., 2008; Rouiller-Fabre et al., 2008; Zhu et al., 2009). These outcomes are analogous to Human Testicular Dysgenesis Syndrome (TDS), a currently studied condition that describes male fetuses that fail to develop normal testis in utero (Foster, 2006; Skakkebaek, 2001). In extreme cases, TDS can lead to testicular germ cell cancer (Skakkebaek, Holm, Hoei-Hansen, Jorgensesn, & Rajpert-De Meyts, 2003).

Similar to exposure analysis studies previously discussed, animal models have their limitations. For example, much of the research that has caused adverse effects involved exposing rats to phthalate levels three to four orders in magnitude higher than most humans are exposed to (Kamrin, 2009). Recent research has begun to explore more relevant phthalate levels in animal models and is still finding adverse outcomes (Meeker et al., 2009; Talsness et al., 2008). However, these studies have tended to focus on one phthalate at a time, while humans are exposed to multiple phthalates at once. The few studies that have looked at the effects of multiple phthalates have noted they work additively to produce the same adverse effects discussed above (Borch, Dalgaard, & Ladefoged, 2005; Hotchikiss et al., 2004; Howdeshell et al., 2008; Rider et al., 2009). Finally, a crucial difference that exists between rat and human biology are the different metabolites produced in their breakdown (CDC, 2009). Different metabolites will exhibit different toxicities as well as different modes of action in vivo. Ultimately, despite the wealth of phthalate experiments done on animals, only a few tentative conclusions can be drawn until more work is done.

2.2.4 *Human Studies*

The amount of studies focused on the potential adverse effects of phthalate exposures on humans is both limited and difficult to interpret (Briggs, 2008). However, the early work has identified similar adverse reproductive outcomes as in animal models (Halden, 2009; Latini et al., 2008). Again, the hypothesis is that phthalates are working as EDs antagonizing androgens in the developing male fetus. It is important to note that no causal links have been established in this work (Swan et al., 2005; EPA, 2009). Accordingly, caution must be taken when interpreting this correlative work.

High phthalate levels in women have been correlated with adverse health issues in pregnancy. Milkov and colleagues (1973) found that chronic occupational exposure to phthalates from female factory workers is associated with decreased rates of pregnancy and higher rates of miscarriage. For example, higher urinary phthalate concentration has been correlated with anemia, deficiency of red blood cells; toxemia, blood poisoning due to a local bacterial infection; and preeclampsia, pregnancy induced high blood pressure; in pregnant women living near plastic manufacturers (Latini et al., 2008).

Phthalates have also been shown to correlate with adverse effects in the developing human fetus and males in particular. High levels of MEHP found in the cord blood have been correlated with shorter gestational age (Latini et al., 2003). In 2008, Swan and colleagues reported a correlation with phthalates and reduced anogenital distance (AGD) in male newborns. This is significant because "AGD is a marker of insufficient foetal androgenisation and suggest that low-dose phthalate exposure may affect several markers of human male genital development" (Meeker et al., 2009, p. 2103). Other adverse outcomes found in male newborns include incomplete sexual

differentiation (Swan et al., 2005), reduced penile size (Swan et al., 2005; Swan et al., 2008; Meeker et al., 2009), and cryptorchidism (National Toxicology Program [NTP], 2005). A higher incidence of cryptorchidism has also been observed in areas near plasticizer factories (Ge, Chen, Tanrikut, & Hard, 2007; Mahood et al., 2006; NTP, 2005; Wilson et al., 2008).

Main, Mortensen, Kalva, and Boisen (2006) studied phthalate levels in breast milk and serum levels in three month old males. Their findings highlighted a series of correlations with phthalate metabolites which are indicative of altered Leydig cell function (Meeker et al., 2009). For example, the metabolite MBP was associated with decreased free testosterone, increased leutenizing hormone, and increased sex hormone binding globulin (SHBG) (Main et al., 2006).

Researchers have found phthalates may exert adverse health effects throughout childhood as well. Colon and colleagues (2000) found phthalate levels were correlated with premature thelarche (breast development) in young female teens in Puerto Rico. Other studies have linked phthalate exposure with adverse pulmonary system outcomes such as eczema and asthma (Bornehag et al., 2004; Kolarik, Naydenov, Larsson, Bornehag, & Sundell, 2008).

In adults, a majority of research regarding phthalates has been on males. Phthalates have been found to significantly impair androgen activity. This includes altered semen quality (Duty et al., 2003; Hauser et al., 2007; Pant, Shukla, Kumar, & Patel, 2008; Zhang, Zheng, & Chen, 2006) as well as altered sex hormone levels (Duty, Calafat, Silva, Ryan & Hauser, 2005; Jonsson, Richthoff, Rylander, Giwercman & Hagmar, 2006; Pan et al., 2006). In women, exposure to phthalates has been linked to

endometriosis (inflammation of the uterus) (Cobellis et al., 2003; Reddy Rozati, Reddy, & Raman, 2006) which can put women at risk for early infertility (Meeker et al., 2009).

Ultimately, much is still unknown about the effects of phthalates on the human biology (EPA, 2009). Specifically, more work is needed to understand the metabolism of phthalates and their mechanisms of action (CDC, 2009). Researchers have also called for the need for more longitudinal studies to gain more accurate estimations of phthalate exposures, especially during sensitive windows of fetal development (Armstrong, 2003; Meeker et al., 2009). Until more is known about phthalates, little can be *scientifically* affirmed about the risks of phthalates. The social implications of this uncertainty will be explored next.

2.3 Policy

Despite the scientific uncertainty regarding phthalates, there still have been political initiatives to control the risk of phthalates. How to best study and regulate these exposures are still a matter of discussion and criticism (Shaxson, 2009). Nonetheless, attempts have been made to regulate the production of phthalates and ultimately decrease their exposure to the public. These policies are often justified in precautionary terms with the goal to limit exposure to the most vulnerable populations until more is known about the risks (Canada Gazette, 2010).

2.3.1 *Children's Toys*

The majority of phthalate policies have been directed towards exposures in toys for young children. A general trend found in the policies limited exposures of DINP, DEHP, DIDP, BBP, and DBP at concentrations that do not exceed 0.1% by weight (Kamrin, 2009). A notable exception would be Australia which has only banned DEHP

in children's toys (Australian Government, 2011). The European Parliament enacted regulations which followed this protocol exactly (European Parliament, 1999) but eventually made their policies stricter by prohibiting the five phthalates completely from children's toys (European Parliament, 2005).

The United States was the next country to take significant regulatory action on phthalates. In 2007, California, Maryland, and Minnesota instituted similar policies regulating the concentration of the five identified phthalates in children's toys (State of California, 2007; State of Maryland, 2007; State of Minnesota, 2008). Minnesota's regulations did go one step further to regulate the levels of DEHP in medical equipment, a major source of phthalate exposure for ill infants (EPA, 2009). A year later, the United States Congress (2008) regulated the five phthalates in children's toys nationwide in the *Consumer Product Safety Improvement Act*. The regulatory work put through by the European Parliament and the United States laid the ground work for the regulations Canada would enact.

Canada's first attempt at reducing Canadians exposures to phthalates was in 1998. Health Canada asked manufacturers, importers, and distributors to stop marketing DINP in soft polyvinyl chloride toys that could be placed in the mouth by young infants. Anticipating further restrictions, the industry voluntarily withdrew DEHP from their toys as well (Canada Gazette, 2010). In 2006, the *Phthalate Control Act* was proposed by the Canadian government which would make DEHP prohibited under the *Hazardous Products Act* in "products that are brought into contact with the mouth of a child of less than three years of age" (Canada Gazette, 2010). Moreover, DBP and BBP were to be reassessed under the Canadian Environmental Protection Act (CEPA). The proposal was

ultimately withdrawn due to the dissolution of the 39th Parliament in September of 2008. Finally, in 2009, Canada's Phthalates Regulations placed phthalates on the *Hazardous Products Act* restricting the concentration of DEHP, DBP, and BBP to "no more than 1000 mg/kg in the vinyl of all children's toys and child care articles" (Canada Gazette, 2010). The concentrations of DINP and DIDP were also restricted to 1000 mg/kg in the vinyl of chewable children's toys for children four years old or younger.

2.3.2 *Cosmetics*

The implementation of phthalate regulations have primarily focused on limiting children's exposure. Although childhood is a sensitive period of development, evidence suggests that it is the developing fetus that is most vulnerable to the endocrine disrupting effects of phthalates (EPA, 2009). It follows that regulations should target reducing women's exposures, especially during pregnancy. This is particularly important given the high phthalate levels women exhibit during pregnancy (Blount et al., 2000). Few policies around the world address women's exposures to low-molecular weight phthalates in cosmetics (Meeker et al., 2009). This review found two policies addressing phthalate levels in cosmetics.

The European Parliament (2004) has added DEHP, DBP, and DMEP on Annex II (prohibited use) and Annex III (restricted use) of the *Cosmetics Directive*. However, the details when and how phthalates are prohibited or restricted were not clearly outlined. In 2008, The Association of Southeast Asian Nations, ASEAN, listed DBP, DEHP, DMEP, BBP, and DNPP, Diisopentylphthalate, N-pentyl iso-pentyl phthalate, on Annex II of their *Cosmetic Directive*. This legislation eliminated these selected phthalates from any cosmetic product.

2.3.3 *Appraising Phthalate Policies*

A majority of the phthalate policies have been reviewed and critiqued within the academic community. The appropriateness and effectiveness of these policies is as controversial as the science regarding the safety of phthalates on health. Some authors have applauded the precautionary approach governments have taken towards phthalates (Steinemann, 2004; ter Meulen, 2005) as it often includes a focus on alternatives research and safe substitutions (Tickner & Geiser, 2004). The European Union's Registration, Evaluation, Authorisation and Restriction of Chemical Substances (REACH) program (2011) has been an exemplar of this precautionary and alternatives based approach. Conversely, other authors take issue with the philosophical grounds of the precautionary principle (Peterson, 2006) and worry about the social harm that may follow (Durodie, 2003).

In a recent paper, Kamrin (2009) conducted a comprehensive critical review of evidence (i.e., methodology, exposures, toxicity, and risk) regarding six target phthalates as well as various policies from around the world. After summarizing over 20 years of science and policy, Kamrin concluded current policies are unlikely to provide any public health benefits. Kamrin believes that the current state of knowledge regarding phthalates is sufficient to deem them safe the need to regulate them is limited. He concludes by suggesting that banning phthalates would lead to manufacturers turning to less-studied phthalate-alternatives thereby exposing society to a new host of risks. The criticisms from Kamrin concur with the general sentiments from other scholars regarding phthalates and other environmental regulations (Durodie, 2003).

These criticisms have been tempered by scholars who stress the complex, social and non-linear process of policy making. Their work considers the term "policy" involves the processes and patterns that shape decisions and lead to particular outcomes (Macgillivray, Alcock, & Bust, 2010; Shaxson, 2009). Using brominated flame retardants as their model, MacGillivray and colleagues (2010) identified three principles that shape policy development: path dependency, the concept that regulatory outcomes are a result of arbitrary starting points; political entrainment, regulation of a risk is caught up in a broader political conflict; and partisan law making, which is the input of the general public in policy development. According to MacGillivray, these three principles directly challenge the notion of whether risk-based policy development can be the foundation of managing household chemical risks effectively. Ultimately, their work suggests that understanding the effectiveness of risk-based regulation must go beyond a simple understanding of the science. What is needed instead is a broader focus on the complex social processes involved in policy development.

Shaxson (2009) offers another framework to understand how science and policy interact with each other, and how we can enhance the development of high quality policies. She highlights four ways science and policy can interact based on the strength of the science, and the clarity of the policy question at hand. *Well-structured problems* have well-defined questions and strong evidence; *moderately structured problems* have well-defined questions but less clear evidence; *Badly structured problems* often have clear evidence but divergent views on what the evidence means; finally, *Unstructured problems* have no real policy questions as well as no agreement on the current state of

knowledge on the topic. Shaxson elaborates on the complexities and social nature of phthalate risk regulation:

> Their widespread use in everyday day products (Koch & Calafat 2009) combined with information on low-dose effects of the chemical to both human health (vom Saal & Welshons 2006) and wildlife (Oehlmann *et al.* 2009) means that the context of the policy question is not 'what levels are safe'? but 'what levels are safe *enough*'? Ethical issues are involved in determining what 'enough' means to different parts of society, implying that however much research is done, the definition of 'safe enough' is not a question that can ever be answered by plastics science alone. (pp. 2144)

Shaxson's argument echoes McGillivray's sentiments regarding the complexities of developing effective risk-based policies regarding phthalates.

Shaxson's work highlights the importance of the social processes involved in risk policy and risk perceptions. Indeed, the social construction of risk is the primary way in which society comes to understand and act on them (Arnoldi, 2010). The discussion will now turn to the media's response to phthalates and how that may affect women's perceptions of these risks.

2.4 Media

The public's understandings, feelings, and perceptions of risks are inextricably intertwined with their media coverage (Arnoldi, 2010; Mackendrick, 2010; Nettleton, Burrows, & O'Malley, 2005). Whether receiving information regarding risks through the media, especially the internet, is beneficial for society is a highly contested issue (Chung, 2011; Nettleton et al., 2005). Media coverage of risks contributes to an individual's

personal knowledge while also providing a frame for interpreting new information (Arnoldi, 2010; Chung, 2011; Mackendrick, 2010). Exactly how the media exerts its influence on the public is currently an open debate (Arnoldi, 2010; Nettleton et al., 2005; Wahlberg and Sjoberg, 2000) with many competing theories at play (Kasperson et al., 1988; Gerbner and Gross, 1976; Tyler and Cook, 1984). Little is known about the complex and recursive relationship that the media and culture share with each other (Arnoldi, 2010). It is noted that the modern public sphere has become increasingly medialized (Saidaba & Winfied, 1997). Therefore, to appreciate how women understand and perceive household chemical risks, one must also look at how the media presents these risks to them.

Media coverage of environmental contaminates such as polychlorinated biphenyls (PCBs) and DDT became prominent in the late 1980s (Mackendrick, 2010). During the 1990s, contaminated consumer goods as well as fear of endocrine disruptors began attracting media attention. Risk of phthalate exposures has been gaining significant media coverage and has been entering the public sphere over the past 20 years (Mackendrick, 2010). The following section examines the available information regarding phthalates found in the media and discusses the potential challenges women may face while appraising it.

2.4.1 *Internet*

On 11 January 2012, a Google search was conducted for the term *phthalates.* The search returned 4,470,000 hits in 0.10 seconds. Previous research indicates that lay internet users often limit their reviews of online material to the first four hits they receive (Eysenback & Kohler, 2002; Nettleton et al., 2005). Accordingly, the first four sites were

reviewed. The first website was developed by the American Chemistry Council (ACC), a lobby group of plastic manufacturers. The site linked to another industry sponsored site by the European Council for Plasticisers and Intermediates (ECPI). Both websites were clear and easy to use. Notably, their affiliations and conflicts were included at the bottom of the sites in small print. Concealing the websites affiliations is potentially problematic for internet users who want to appraise the information and who they are receiving it from. Without knowledge that this website is funded by the plastic industry, users may be less skeptical about the information, more likely to accept it as accurate, and subsequently make decisions based on a biased interpretation of the data.

The ACC makes fairly strong affirmations about the safety of phthalates and the current state of knowledge. The site suggests that current regulations regarding phthalates use are not "based in science" (ACC, 2012). Their claim is followed by a quote from an unidentified scientist claiming that he does not believe that phthalates pose a risk to children. The ECPI (2012) make equally strong claims about European Policies and the safety of phthalates.

The second website from the search results was the Wikipedia (2012) page on phthalates. This page gives a detailed account of what phthalates are, some of the current regulations, sources of exposures, and a review of the adverse health effects phthalates can have. The page is also well sourced with references to peer-reviewed articles. A potential problem is the use of scientific and political jargon, which could make it difficult for lay readers to read and understand. Regardless, Wikipedia does offer a fairly comprehensive and balanced review of phthalates, their risks, and political responses.

The third website was entitled *Our Stolen Future*. The site is based on the book of the same name published in 1996 by Colborn, Dumanoski, and Myers. The authors write in a rather alarmist tone warning readers about the "acute" effects of low dose exposures to phthalates and the "dramatic" changes in male sexual characteristics (Our Stolen Future, 2006). The authors also take time to criticize websites developed by plastics industry, such as the ACC and ECPI, which minimize the threat of phthalates. They accuse them of misinterpreting and ignoring a wealth of scientific work as well as mistaking the absence of evidence as evidence of absence.

Finally, the fourth result was a phthalate fact sheet recently updated in 2011 by Health Canada. The page describes the potential adverse effects of phthalates, provides a brief summary of Canada's current regulations, and encourages parents to "monitor" their children's use of soft plastic toys that are used for chewing (Health Canada, 2011). The site is brief, clear, and informative.

The ease of accessibility along with the vast amount of information found on the internet make it a key factor in the amplification, de-amplification, and framing of health risks in society (Chung, 2011; Mackendrick, 2010; Nettleton et al., 2005). In the first four sites alone, users are exposed to a vast amount of conflicting and contradicting evidence regarding phthalates. This can potentially create an environment that is confusing and potentially irrational to the user (Nettleton et al., 2005).

2.4.2 *Other Media*

On 23 November 2011, Fox News ran a story entitled: *Lead, Phthalates, Choking Still a Danger in Children's Toys*. The segment warned consumers that "hidden dangers lurk in some of those less expensive toys that parents might grab as stocking stuffers this

time of year…" (Fox News, 2011). The Canadian Broadcasting Company (CBC) ran a story titled *Phthalates: Soft Plastic's Hidden Hazard* on 18 January 2011. On 31 May 2010, the Cable News Network (CNN) included phthalates as one of five toxins that are "everywhere" and urged their audience to protect themselves from the danger. Finally, the women's magazine, Glamour, published a story identifying phthalates as one of *The New Toxic Threats to Women's Health*. The article explains that phthalates are "in your bathroom, your kitchen, your fridge – and mounting research hints they could be wreaking havoc on your weight, fertility and immune system" (Glamour, 2011). From this brief review of media coverage of phthalates, it is not hard to appreciate the ease of access of this information as well as the conflicting nature of the reports.

2.4.3 *Media Frames*

An important consideration to make when studying the construction of media stories, is how the stories are framed (Arnoldi, 2010). The framing of the media stories help define problems, suggest causal relationships and attribute responsibility for the audience. Mackendrick (2010) reviewed over 20 years of Canadian newspaper articles regarding environmental hazards and body burdens to study how the stories have been framed. In her article, she notes that the media has shifted the focus of body burdens from a collective problem (i.e., issues concerning regulations, production, and research of chemicals) to a more personal problem that she has labelled "precautionary consumption" (pp.127).

According to Mackendrick (2010), precautionary consumption places responsibility to avoid body burdens on the individual by suggesting that specific consumer behaviours can reduce exposures to harmful chemicals. This framing is

consistent with increased individualization that has been observed within modern western society (Beck, 1992; Rose, 1999). Given the systemic and ubiquitous nature of environmental risks, Mackendrick questions if this is an appropriate way to frame issues of body burden. She notes that little is known about the impact of this framing on women, pregnancy and motherhood and more work in that area is warranted.

2.5 Risk, Women, and Pregnancy

The previous section has focused on characterizing current knowledge of phthalates, their potential risks, and the social response to these risks through policies, regulations and media. The inherent controversies and uncertainties found in the conceptualization, regulation, and communication of household chemical risk, specifically in the context of phthalates, were revealed in the literature. The discussion now turns to the social implications of these controversies and uncertainties on perception of risk.

The concept of risk is fundamental to the way the general public and experts in modern society organize the social world (Murphy, 2000). MacKenzie Bryers and van Teijlingen (2010) discuss four areas of risk. The first three (epidemiology, statistical, and operational) are considered objective, calculable risks. These three types are frequently used by specialists to understand risk. The fourth focuses on the sociology of risk. That is, how subjective perceptions of risk are socially constructed by the lay population and how these perceptions shape community and individual agency. MacKenzie Bryers and van Teijlingen (2010) argue that, given that all risk assessments are dependent on some human process, one cannot separate objective and subjective risk appraisals from each other. Accordingly, given that this section is focused on the social responses to risk of

phthalates and other household chemical exposures, we will now turn to the prominent sociological risk theories.

2.5.1 *Sociology of Risk*

There are three predominant social theories of risk (Arnoldi, 2010). One of the most influential risk theories is the cultural theory of risk put forth by the cultural anthropologist Mary Douglas and political scientist Aaron Wildavsky (1983). The origins of this theory came from Douglas' work in the 1960s regarding how tribal societies perceive 'danger' taboos (e.g., contact between women and cattle in Uganda) as pollution. Her work found that perceived causal explanations for misfortune developed by societies reinforced social customs and beliefs (Arnoldi, 2010).

Douglas and Wildavsky (1983) emphasize the importance of culture and collective values on our perceptions of taboos and risks. The basic assertion of this theory claims that an individual's perception of risk is shaped by his or her social context (i.e., the community, various organisations, peer group influences, and other sources of authority) (Tansey & O'Riordan, 1999). Thus, society and culture is given a fundamental role in the development of individual perceptions of risk (Arnoldi, 2010). Although more objective accounts of risk can be taken into account, it will always be construed by human, subjectively-mediated processes (Tansey & O'Riordan, 1999).

Ulrich Beck's 'risk society' offers a related but distinct understanding of the social nature of risks (Arnoldi, 2010). For Beck (1992), the 'risk society' arose from the beginning of modern society (MacKenzie Bryers & van Teijlingen, 2010) and widespread ecological degradation (e.g., contaminated breast milk, radioactive disasters) (Mackendrick, 2010). The risk society is characterized by risks that transcend

geographical barriers that threaten human life and information systems that make these risks known to the general population (Beck, 1992). Moreover, these risks are no longer managed by traditional, high-trust institutions such as kinship, religion, and local community but by private institutions such as the market, science, and technology (Ekberg, 2007; Mackendrick, 2010). Since these new institutions have little public accountability, the production of risks cannot be easily attributed to an identifiable agent or actor. Beck (1992) refers to this as a state of organized irresponsibility; a state where risks have no easily identifiable actor or institution as their source (Arnoldi, 2010). Beck argues that the responsibility of negotiating risks subsequently falls on the individual. In turn, this new accountably and autonomy has led to a society that is overly concerned and anxious about risk (Mackendrick, 2010).

The third theory is Foucault's theory of governmentality (Lupton, 1999). This theory is not an explicit exploration of the role risk plays in society. Instead, Foucault (1991) argues that communities and individuals are governed through the processes of measurement, wealth, health, and welfare. Accordingly, understanding risk and subsequently managing and minimizing risk is a key tool used in the governmentality of populations (Arnoldi, 2010). In this theory, risk calculations are made in order to properly manage individuals in their communities. Taken cumulatively, these three theories offer insight into the social constructions, functions, and implications of risks in modern society.

2.5.2 *Sociology of Risk, Phthalates, and Women*

When a sociological approach to risk is applied to the science, policies, and media stories around phthalates, the reasons for the controversies become clearer.

Disagreements regarding the threat of phthalates to our health are better understood when we realize the importance of culture and values in shaping our perceptions of risk (Arnoldi, 2010; Beck, 1992; Douglas and Wildavsky, 1983). The more uncertainty there is regarding the scientific characterization of risk, the more one can expect values and morals to play a role in shaping people's perception of risk. The various controversies surrounding the interpretation of phthalate science as well as the effectiveness of the policies are a product of the value mediated and culturally bound processes humans use to appraise risks. As Arnoldi (2010) argues,

> Risks are constantly defined, contested and interpreted in the public sphere, in political debates, in the mass media and so on. In these interpretations the 'objective' potential risks fuse with values, so that values defining what is right cannot be separated from facts about what is dangerous (Beck, 2007:32) (pp. 49).

In the context of exposure to household chemical risks such as phthalates, then, it is prudent to determine what are the current understanding and perceptions of these risks in society. The threats of phthalates will likely impact men and women who have no intention of becoming pregnant as they too are a part of the social construction of risk. However, there is evidence to suggest that mothers and pregnant women should receive extra attention. It is reasonable to ask, more specifically: what is the knowledge, perception and understandings of pregnant women regarding phthalates and risk during pregnancy?

Firstly, as previously discussed, the developing fetus is most vulnerable to the effects of endocrine disruptors at environmentally relevant levels (Blount et al., 2000; Hutchinson et al., 2008; Lague and Tremblay, 2008; Talsness et al., 2009). Thus, from an

evidentiary and pragmatic perspective, pregnant women should be a key target population.

The second consideration is the gendered nature of environmental labour. In an analysis of a 1993 General Social Survey, Blocker and Eckberg (1997) found that women are generally more concerned about pollution than men and take part in more environmentally conscious behaviour. Moreover, the researchers observed that having children increased the likelihood of women developing a more "green" lifestyle while it decreased the tendency in men. Zelezny, Chua, and Aldrich (2000) attributed women's propensity to adopt more "green" lifestyles due to socialization processes which encourage women to be more *other* oriented and socially responsible.

In an international survey of environmental behaviours, Hunter, Hatch and Johnson (2004) found women often take responsibility for environmentally conscious behaviour in the domestic sphere (e.g., shopping, recycling, and compost). This study confirms similar findings of other researchers (Blocker & Eckberg, 1997; Zelezny et al., 2000) and is one of the first studies to observe this phenomenon internationally. The results of these studies support the argument that if we are to be concerned with the lay public's perceptions of phthalates, we should focus on women, particularly mothers. A lack of understanding regarding pregnant women's experiences and perceptions of risk provides the final line of reasoning necessary to justify further study regarding pregnant women's perceptions of exposure to household chemical risks.

2.5.3 *Interweaving Discourses of Motherhood and Risk*

Women are constantly confronted with varying and contradictory discourses regarding pregnancy, reproduction, and motherhood (Lupton, 1999; Miller, 2005).

Women's biological ties to reproduction and childbirth have brought essential and universal assumptions of women's "natural" and "instinctive" capacity for mothering (Miller, 2005). However, it has been well established by feminist scholarship that the concept of motherhood is socially constructed. Indeed, women's experiences of motherhood are unique, shaped by race, socio-cultural context, age, and social class (Kelha, 2009). Miller (2007) offers empirical evidence of these claims as she follows women during their transition to first-time motherhood. Throughout pregnancy and child birth, these women spoke about mothering through predominantly natural discourses. However, during interviews regarding early mothering, the women realized that "nature turns out not to have been 'a force to be trusted'" (p.349). Instead, mothering and nurturing becomes seen as a skill set that must be learned.

Notions of motherhood have also been influenced by various political agendas (Tardy, 2000). A landmark piece that has shaped contemporary conceptions of motherhood is Wollstonecraft's (1792) *Vindication of the Right's of Women*. Wollstonecraft believed children were delicate and sinless beings that required all of their mother's attention. Tending to the needs of her children, then, was a way for women to carve out an essential space for themselves in society rather than solely dependent on their husbands. In the 1950s, psychoanalytic research linking motherly love with children's physical health was used by political organizations to enforce the notion of a special link between mother and child (Tardy, 2000).

Modern, technical notions of risk that stress individual responsibilities of reducing risk have played a significant role in shaping women's experiences of motherhood in Western societies (Lupton, 1999; Miller, 2005; Murphy, 2000). These authors have

argued that these orientations towards risk have manifested in a culture intensive mothering; the idea that women must put their children ahead of themselves (Lee, 2008). Failure to do so puts the woman at risk of being seen as careless, irresponsible and labelled as a bad mother. As Murphy (2000) explains: the "mother's main function is assumed to be maximizing the physical and psychological outcomes for their children and any suggestion that mothers are not energetically pursuing this goal leaves them, at least potentially, vulnerable to criticism" (p. 295). In short, modern, technical discourses of risk place responsibility on mothers for future health outcomes of her children.

Consistent with the increasing predominance of modern discourses of risk is the increased medicalization of pregnancy (Conrad, 1992; Horton-Salway & Locke, 2010; Miller 2005) and the need for women to seek expert guidance (Lupton, 1999; Mackenzie Bryers & van Teijlingen, 2010; Miller, 2005). The main assumption behind the medicalization of pregnancy is the idea that pregnancy and childbirth is a time of risk and danger (Parry, 2008). This assumption shifts the view of pregnancy and child-birth from a natural and normal phenomenon to one that is seen as an unnatural condition or illness (Jordan & Murphy, 2009). For Parry (2008), this unnatural state becomes the domain "of medical professionals who determine, control, and rectify potential or actual problems during pregnancy and childbirth" (p.786).

While the application of obstetrical procedures has increased with hopes of reducing negative outcomes in pregnancy, this has not necessarily lead to improved maternal and infant health (Kringeland & Moller, 2006). Moreover, the increased control of the medical profession can have the effect of pushing women's experiences and knowledge of their own body to the periphery of their care. This can be an alienating

experience for women (Jordan & Murphy, 2009; Lupton, 1999). Despite the power exerted by medical discourses in pregnancy, mothers are still charged with the responsibility to ensure the health of themselves, their family by seeking out expert advice, and making responsible and informed decisions (Miller, 2005; Tardy, 2000).

The conflicts between natural and medical (risk based) discourses in motherhood can pose significant challenges to pregnant women. Women who are told to trust their bodies during pregnancy must also come to terms with the expectation to submit to expert advice to minimize risk and promote the well-being of their fetus (Miller, 2007; Tardy, 2000). As Lupton (1999) concludes:

> The proliferation of risk discourse around pregnancy and the accompanying assumption that women should take care to avoid risk as much as possible has had the effect of rendering pregnancy as a perilous journey, requiring eternal vigilance on the part of the women travelling through it (pp. 66).

Ultimately, it seems, at least from a conceptual perspective, there is cause for concern regarding pregnant women and their perceptions of the risk of phthalates, and other household chemicals. A reasonable question would then be to ask: what empirical evidence exists regarding pregnant women's perceptions and experiences with risk?

2.5.4 *Pregnant Women's Experiences with Risk*

The feminist qualitative research done regarding pregnant women's experiences with risk is particularly insightful (Lupton, 1999). Most of the work looks at the impact of risk discourse on women's identity as mothers. For example, women over the age of 40 who go through pregnancy are often labelled as high-risk by the medical community (Kelha, 2009). Given the risks involved, there is an increased need for antenatal care,

more contact with medical experts, and extra prenatal screening. A study of older women's perceptions of their high-risk pregnancy found that the women often submitted to medical authority and the extra precautionary procedures (Kelha, 2009). In doing so, the participants aligned themselves with perceptions of good mothers in their society. However, this often came at the cost of increased anxiety (especially regarding therapeutic abortion), and feelings of losing control over their pregnancy.

Other studies have explored prenatal genetic counseling (Hunt, Castaneda, de Voogd, 2006; Lupton, 1999), breast feeding (Lee, 2008; Murphy, 2000), and the impact of prenatal classes on shaping discourses in pregnancy (Horton-Salway & Locke, 2010). These studies demonstrate that most women often agree with and aspire to conform to the idealized role of motherhood and expert authority (Lupton, 1999; Miller, 2007). Women in these studies, however, often fell short of these goals. For example, Murphy's (2000) study found that most women did not continue breast feeding for the recommended minimum of four months. Although the participants expressed feelings of regret, most justified their decisions to switch to formula feeding and maintained their self-perceptions as a good mother. As Murphy observes:

> The accounts advanced by these women to legitimate formula feeding can be understood as attempts at realignment of self with the ideology of motherhood. Through their talk, mothers were addressing the disjunction between their own experiences of motherhood and expert prescriptions about optimal maternal behaviour (pp. 319).

Horton-Salway and Locke's (2010) work on the influence of expert-based risk discourses in prenatal classes found parental agency embedded in rhetoric of choice. Here, the idea

of autonomous consent is illusory. Instead, acting on expert advice and participating in antenatal testing are expectations espoused by the prenatal classes. These studies highlight the intense social and moral pressure women experience to be good, responsible mothers and how expert discourses of risk contribute to and shape these experiences.

Women's perceptions of risk are highly individualized and variable upon many factors (Gupton, Heaman, & Wang-Kit, 2001; Jordan & Murphy, 2009; Mackenzie Bryers & van Teijlingen. 2010). Women's perceptions of risk are influenced by their social constructs, life experiences, and their health care provider's perceptions (Darbyshire, Collins, McDonald, & Hiller, 2003; Searle, 1996). Jordan and Murphy (2009) argue that women's perceptions of risk in pregnancy are also shaped by public information, which, in Western countries, characterizes pregnancy as a time of danger. Results from one study that explored women's perceptions of risk during pregnancy in Northeast Brazil stressed the impact of social context (Atkinson & Farias, 1995). The women perceived the risk of caesarean sections and future pregnancies as an important reason to receive prenatal care services. The researchers attributed these perceptions to the high frequency of caesarian sections in Brazil as well as the poor and peri-urban circumstances in which these women lived (Artkinson & Farias, 1995). Similarly, pregnant women in Mozambique reported the belief that delaying prenatal care until late in pregnancy was a preventative and health protecting activity (Chapman, 2003). This stemmed from the women's belief that public knowledge of their pregnancy would put them at risk; another culturally bound perception (Chapman, 2003).

Research has also shown that women have a tendency to over-estimate their actual risk during pregnancy (Brewer, Weinstein, Cuite, & Herrington, 2004; Jordan &

Murphy, 2009). One study found that women with complicated pregnancies perceive themselves at higher risk than women with uncomplicated pregnancies despite similar maternal and fetal outcomes during pregnancy (Gupton, Heaman, & Wang-Kit, 2001). Studies have also demonstrated that pregnant women often overestimate the risks of commonly used drugs (e.g., psychotropic drugs, alcohol use, and smoking) in relation to their effects on pregnancy (Nordeng, Ystrom, Einarson, 2010). Brownsyne, Edmonds, and Coleman (2011) found that pregnant women's distress regarding acquiring H1N1 disease was a significant predictor in intention to receive the H1N1 vaccination.

Pregnant women's risk perceptions also have implications for decision making during pregnancy (Hunt, Castaneda, & de Voogd, 2006). If a woman perceives her pregnancy to be at high risk, she is more likely to doubt her ability to give birth naturally, experience a loss of control, experience more distress, and have lower perceived self-efficacy (Gottvall & Waldenstrom, 2002; Jordan & Murphy, 2009). Accordingly, women who perceive themselves as high risk are more likely to defer their decision making to their health professionals. This can lead to increased medicalization, taking a passive role and continued loss of control during pregnancy (Horton-Salway & Locke, 2010; MacKenzie Bryers & von Teijlingen, 2010).

The various ways women perceive and understand risk have implications for how those risks are communicated. Women and clinicians carry complex and divergent connotations of risk (Hunt, Castaneda & de Voogd, 2006). Women's understanding of risk are more focused on danger and are experientially based while clinicians focus on statistical, and actuarial accounts of risk (Lupton, 1999). However, Hunt and colleagues

(2006) point out that the linguistic similarities between these different connotations of risk often lead to misunderstandings in clinical situations.

Jordan and Murphy (2009) out line three general ways risk can be communicated: absolute risk, the likelihood of an event occurring; relative risk, the probability of an adverse event in one group relative to another; and attributable risk, the potential of other adverse events occurring due to an initial risk factor. Health professionals should be sensitive to how risks are framed when communicating them with women (Jordan & Murphy, 2009; Miller & Solomon, 2003). For example, in a study examining women's perceptions of interpretive labels of the same numerical prenatal screening test result, pregnant women perceived their risk as higher when it was labelled positive or abnormal as opposed to negative or normal (Zikmund-Fisher, Fagerlin, Keeton, & Ubel, 2007).

Evidence indicates that improved clinician-patient communication can, amongst other health benefits, empower patients and their decision making ability (Street, Makoul, Arora, & Epstein, 2009). However, no communication theory has satisfactorily predicted any particular causal explanation. Headley and Harrigan's (2009) work point to the need for increased health literacy amongst the general population in order to help develop women's appreciation of risk information and to improve their decision making. Similar sentiments are offered by Nordeng, Ystrom and Einarson (2010) who found that increased evidence-based information helped reduce risk related anxiety in pregnant women.

Focusing specifically on environmental risks, Miller and Solomon (2003) have identified medical clinicians as one of the most trusted yet poorly equipped sources of

risk-related information for patients. Given the objective and subjective nature of risks, the authors argue that:

> A scientist's perception of risk is not necessarily 'correct,' and a lay person's perceptions are not necessarily 'incorrect.' It is important to approach questions humbly with an understanding of the limitations of the science and the importance of social context (pp.213).

The authors offer various cognitive shortcuts (known as heurestics) people use to evaluate risks and conclude by offering seven rules of risk communication. These rules include listening to the public, being honest, being compassionate, and working towards resolution.

2.6 A Gap in the Literature

Considerable research has gone into understanding women's perceptions of risk, and how these perceptions influence their experience of pregnancy and motherhood. In addition, evidence suggests women's autonomy, sense of control and decision making can be compromised as a result of the prominence of medical-risk discourses. None of the aforementioned studies, however, have examined women's experiences with less concrete risks such as phthalates and other common household chemicals. What do pregnant women know about the risk of phthalates? What impact does knowledge of risk of phthalates have on pregnant women hoping to achieve healthy pregnancy? Do women feel equipped with the appropriate information and social networks to make informed decisions regarding these risks? Most importantly, what are the experiences of pregnant women dealing with risks? It is the conclusion of this literature review that there is a lack

of knowledge in this area of motherhood and risk perception and further research is needed.

2.7 Conclusion

This review began with a discussion of the difficulties conceptualizing and achieving healthy pregnancies. It was discussed how these difficulties are particularly prevalent in issues regarding household chemical risks. Phthalates were used as an exemplar to demonstrate the ubiquitous nature of household chemicals as well as the complex ways they interact with the environment and effect health. A review of the current political and media responses to phthalates were then presented to demonstrate the social responses to household chemical risk and how they can potentially contribute to women's exposures and perceptions of risk. Conceptual and empirical work was then presented to highlight how the previous topics coalesce and impact women hoping to achieve healthy pregnancy and achieve the ideals of motherhood. However, it was noted that the current literature was limited in its empirical evidence of illuminating how pregnant women experience, understand, and act on information regarding environmental risk. This allowed the review to identify a gap in the literature and call for more work to be done in this area. The following chapter will explore how a grounded theory methodology was used to help address this current gap in the literature and explore these issues empirically.

3 METHODOLOGICAL APPROACH

3.1 Introduction

Constructivist grounded theory as described by Charmaz (2006) was used to understand women's as well as obstetrical care providers' understanding, knowledge, and experiences of household chemical risks with phthalates as a model. The chapter begins with a discussion of the ontological and epistemological assumptions that ground the research followed by a description of the methodologies and research methods used to collect, analyze, and interpret data. The chapter concludes with a discussion of how quality was ensured in the project as well as how various ethical considerations were addressed throughout the research.

3.2 Philosophical and Theoretical Positioning

The current research project is situated in between feminist and sociology of risk literature. Scholars in these fields often work from different but overlapping ontologies and epistemologies. Most of the work found in the sociology of risk literature subscribes to a constructivist paradigm (Arnoldi, 2010; Beck, 1992; Douglas and Wildawsky, 1983). Here, reality is context dependent and locally constructed (relativist ontology) and new understandings are co-created amongst individuals (subjectivist epistemology) (Guba & Lincoln, 1994). Methodologically, constructivists argue that knowledge is created, refined and given meaning between investigator and respondent in an on-going dialogue until an informed and refined consensus inquiry at hand is reached. A notable risk theorist that does not subscribe to a constructivist paradigm is Foucault (Arnoldi, 2010; Lupton, 1999) whose work is located in the critical paradigm described below.

Generally, feminist work often finds itself situated in a critical paradigm. This view argues that reality is structured, often incorrectly, by historical trends that can be revealed through value-mediated processes. That is, feminist work subscribes ontologically to historical realism and a subjectivist epistemology (Guba & Lincoln, 1994). Through a dialogical methodology, social, political, historical, and economic trends that have shaped our understandings of reality and gender over time are revealed and challenged. This, in turn, transforms the researcher's and participant's consciousness and provides hope for the future (Guba & Lincoln, 1994). The feminist studies previously reviewed subscribe, at least in part, to this paradigm (Lupton, 1999; Tardy, 2000).

A closer review of the qualitative research being conducted by the feminists studying motherhood, however, reveals more constructivist tendencies. Although the authors such as Lupton (1999), Murphy (2000), Tardy (2009) and Miller (2007) claim that their work in line with critical-feminist literature, the nature of the research often looks to co-create new meanings with the participants as opposed to transformation; a critical component to critical research. Rebecca Tardy's (2000) work on motherhood and healthcare provides the clearest example of this critical-constructivist approach. The introduction to her study provides a critical analysis of the discourses and tensions of motherhood in society. However, Tardy's research goals focus on the social construction of motherhood through an ethnographic methodology. This positions the actual research in a constructivist paradigm.

Particular attention was given to the philosophical foundation of my research project. This was because each paradigm carries with it implications for how the research is subsequently unfolds. It was important, then, to choose a paradigm that would best

serve the research question as well as remain consistent with my experiences and views of reality.

3.2.1 *My Theoretical Positioning*

I am a novice qualitative researcher with a strong background working in a post-positivist paradigm. I have researched the patterns of biochemical markers of children with Kawasaki's disease. Moreover, I have completed two university level quantitative statistics courses. Notably, I have had experience completing two qualitative research projects for two undergraduate course requirements. One was a case study of an elderly woman with a motor-neuronal disease non-specified and the other was a needs assessment for a physical activity social marketing campaign. The two projects have given me insight into the challenges of conceiving, conducting and analysing qualitative work. Both studies, however, lacked a solid philosophical foundation.

My recent experiences have allowed me to engage with various ontologies, epistemologies, and methodologies and reflect on which ones best suit my perspectives and research questions. For the purposes of this research, I worked within a constructivist paradigm. My reasoning for this is two-fold. Firstly, the concepts of risk and motherhood limited my choices between a constructivist and critical paradigm. If I accepted a more post-positivist view, my work would be more focused on the statistical calculations of risk of phthalates and women's appreciation of these calculations. Ultimately, I would have lost the opportunity to explore the experiences, emotions, and understanding of pregnant women when they encounter these risks.

Secondly, I believe that the premises of constructivism resonate with me more than critical theory. I accept that there are multiple realities and they are co-created

through social interaction. Within a research context, I do not believe that I can remove myself from the process when collecting and analyzing data. The knowledge created is transactional, producing findings that are subjective and co-created. My results do not represent an ultimate truth but one out of many potential truths that can exist. Having discussed my research question and theoretical positioning, I can now properly discuss the details of my research design.

3.3 Methodology

Grounded theory is a qualitative methodology that was developed in 1967 by Glaser and Strauss (Charmaz, 2003). It was conceived as an alternative method to quantitative means of examining phenomena. The original conception of this methodology relies on the use of rigorous analytical methods to immerse the researcher within the data. The researcher is encouraged to use other methods such as memo writing and theoretical sampling to gain a fuller understanding of the data. The ultimate goal is to create a middle-range theory that is *grounded* in the data (Stanley, 2006). Grounded theory is often used to examine questions of "how" and uncover latent social patterns and structures of an area of interest. Accordingly, exploring how pregnant women perceive environmental risks and subsequently mitigate their exposures fits within the aims of this methodology.

The original conception of grounded theory has been criticized for its strong positivist tendencies. Indeed, the methods proposed by Glaser and Strauss were presented to limit researcher influence on the data and develop a theory that is separate from and independent of the investigator's subjectivities (Mills, Bonner & Francis, 2006). Given the constructivist nature of this current research, the grounded theory methodology, as

proposed by Glaser and Strauss, would be insufficient. Mills and colleagues (2006) point out that the revisions of grounded theory by Strauss and Corbin have adopted more constructivist tendencies, but note that they still write with a lot of paradigmatic ambiguity. Mills suggests that Kathy Charmaz, a former student of Strauss, has developed the most coherent and comprehensive work on constructivist grounded theory.

3.3.1 *Constructivist Grounded Theory*

The fundamental difference between previous versions of objectivist grounded theory and constructivist grounded theory is that the latter explicitly acknowledges the researcher as a co-creator of the knowledge (Charmaz, 2003). Constructivist grounded theory involves a more open-ended and emergent process than previous forms of grounded theory. To do this, Charmaz reclaims the tools of grounded theory by rejecting the systematic ways they were applied. An example is the more fluid analysis structure. The hierarchical coding process is replaced with a less strict interpretation of the analysis tools. Investigators are encouraged to step out of the grounded theory procedure and apply a coding system that best suits the data at hand. Charmaz calls for the use of tools in a creative and interpretive manner. For example, memo writing is used for researchers to be reflexive and help unearth the co-construction process. Previously, memo writing was used to identify and remove researcher bias from the work Charmaz provides constructivist investigators with an effective means to conduct meaningful grounded theory research without being constrained by its original positivist roots. The researcher's beliefs, values and data are intertwined and recognition is given to revealing multiple realities rather than a basic underlying process. Given the constructivist foundations of

my research along with the exploratory nature of my research questions, I subscribed to a constructivist grounded theory methodology to guide my research process.

3.4 Method

Essential to qualitative research in general and grounded theory in particular is its ongoing, iterative, and simultaneous nature of the work (Charmaz, 2003). In grounded theory, sampling, data collection, and analysis are interdependent processes, constantly informing and influencing each other and subsequent phases of the research. Accordingly, these elements of the research often overlap. However, for the sake of organization and comprehension, these issues will be discussed individually. The following discussion provides the general outline for how my research was approached and how flexibility was built into the design to ensure the dynamic nature of the research process would not be impeded.

3.4.1 *Sampling*

In qualitative research, the sampling strategy chosen should be relevant to the research question at hand as well as the conceptual framework that the research is based (Curtis, Gesler, Smith, & Washburn, 2000). Purposeful sampling was used (Curtis et al., 2000) to recruit participants who would best address the research question at hand (Miles & Huberman, 1994). Accordingly, given that research question is focused on pregnant women's perceptions of household chemical risk, both pregnant women and obstetrical care providers (i.e., family physicians, midwives, and obstetrician-gynaecologists) were sampled. By sampling pregnant women, I was able to gain insight into the way pregnant women negotiate information regarding risks in the environment and how this impacts their sense of self, autonomy, and motherhood.

Previous research has identified obstetrical care providers as important resources of risk information during pregnancy (Miller & Solomon, 2003). Accordingly, clinicians are a significant influence in the construction of women's risk perceptions (Lupton, 1999; Murphy, 2000; Walter, Emery, Braithwaite, & Marteau, 2004). Understanding how experts perceive and manage the risks of phthalates in their care for pregnant women will help identify potential tensions and similarities in the pregnant women-obstetrical care provider relationship.

In order to elicit a wide range of perspectives and understandings, very few inclusion and exclusion criteria were applied. Women had to be pregnant at the time of recruitment, English speaking and 18 years of age or older. These criteria were put in place to help facilitate the informed consent process as well as ensure the participants could appreciate some of the complexity regarding phthalates. Clinicians had to be English speaking and provide regular prenatal care for pregnant women.

Pregnant women from Southwestern Ontario were recruited through posters (Appendix C) and pamphlets (Appendix D) placed in physician and midwifery clinics as well as prenatal classes. Obstetrical care providers were recruited by members of the research team through personal communication such as e-mail, phone, and letters. Interviews were conducted in London, Chatham, Sarnia, and Walkerton. To help ensure voluntary participation, participants were given a verbal explanation of the project, a written description of the research and an opportunity to ask any questions they might have had prior to signing an informed consent form (Appendix E). Participants were also reminded that their identities would remain confidential and they had the right to refuse any question as well as withdraw consent to participate at any time.

3.4.2 *Theoretical Sampling*

As the research project progressed and concepts and themes emerged from the data, new analytic inquiries arose. The first model that emerged from analysis framed the issue of risk in pregnancy from a social perspective. As I reflected on this perspective, new theoretical directions emerged. Specifically, I wanted to develop a more personal account of the women's experience regarding risk information and their decision making process. Accordingly, the sampling strategies broadened to include pregnant women from rural as well as urban contexts to gain rich and diverse perspectives.

Modifying sampling strategies to address emergent theoretical directions is known as theoretical sampling (Charmaz, 2006). Theoretical sampling was an important part of maintaining flexibility in grounded theory as well as developing a mature and well-rounded project (Stanley, 2006). Participants were recruited throughout the research process to further develop themes arising from the analysis. Recruitment came to an end when theoretical saturation was reached (Charmaz, 2003). That is, when analysis was no longer revealing new themes, concepts, and insights. Although recruiting was, in a sense, open ended, practical limitations were imposed given the short time frame of the project. For pragmatic reasons, a sampling maximum of 30 pregnant women and 20 obstetrical care providers was put in place.

3.4.3 *Data Collection*

Collecting rich data is essential to understanding phenomenon qualitatively and developing meaningful theories (Charmaz, 2006). Glaser (2002), one of the fathers of grounded theory, once claimed that "all is data" (Introduction, para. 1). This is a sentiment I maintained throughout the data collection phase of my research. My goal was

to remain open to the many ways knowledge can be created and try to capture as much of the available data as possible.

3.4.3.1 *Interviews*

Interviews were the primary means of data collection for this study. According to Charmaz (2006), intensive interviewing is an ideal method for constructivist grounded theory as it "permits an in-depth exploration of a particular topic or experience" (pp. 25). Interviews help to capture both women's and clinician's experiences with household chemical risk during pregnancy. Interviews have been shown to be ideal when dealing with sensitive issues such as motherhood, risk, and healthcare (Lupton, 1999; Tardy, 2002). Interviews allow women to speak more (but not necessarily completely) freely about their experiences, uncertainties, and understandings without worry about judgement from others (Tardy, 2002).

Interviews are best thought of as a directed conversation (Charmaz, 2006) or a conversation with a purpose (Mason, 2002). This can create a tension between the free-flowing nature of conversation against the structure and focus of scholarly inquiry (Mason, 2002). To address this issue, a semi-structured interview guide was used. In addition, the research team and I used nine prompts (Appendix F) to help keep the interviews focused while allowing for participants to discuss a wide range of issues they believed to be salient. The prompts were refined throughout the research process as new insights pointed to more effective ways to elicit rich and meaningful data. To ensure the interview process was a co-construction of knowledge between the investigator and participants, participants were asked to draw upon personal experiences of risk and pregnancy. The intention was to produce responses that were grounded in the

participant's life. Contextualized responses provide insight into the social worlds of the participants and offers fertile grounds for the investigator and participant to engage in the co-construction of knowledge (Mason, 2002).

The interview consisted of three interrelated and iterative sections. The first part of the interview focused on participant's experiences with risks in pregnancy, their perceptions of household chemical risks, and their access to resources regarding risk. General information regarding phthalates including sources of exposure and potential health outcomes were then provided. The interview then focused on participant's understandings of the risk of phthalates, how exposures may affect pregnancies, and what other information would be helpful for them to know. Finally, the participants were offered an opportunity to ask their own questions, clarify misunderstandings, or share any remaining thoughts. The pacing of the interview was determined by the richness of the participants' responses and the overall flow and atmosphere of the interview.

Participants engaged in 20 to 40 minute interviews which were audiotaped and transcribed verbatim by a professional transcriptionist with the research participants' tone, pauses and inflection noted. Field notes were taken and included as memos for the analysis. Most pregnant women were interviewed either before or after their appointments with their physicians. The clinicians were interviewed in their office and the patients were interviewed in an empty examination room. The interviews were conducted by the researcher and two other members of the research team. A second researcher was available to take these notes while the other focused on conducting the interview and remaining engaged with the participant. Ultimately, the flexible and dialogic nature of the interviews was the primary means of exploring participant's

experiences with household chemical risks. However, as already alluded to, the study relied on other complimentary means of data collection to ensure a full understanding was developed.

3.4.3.2 *Field Notes*

Crucial to a constructivist approach to grounded theory is the acknowledgement of the influence context has on the knowledge creation process (Guba & Lincoln, 1994). Factors such as where and when the interview is taking place, as well as the backgrounds of the participants shape the knowledge construction process. Making detailed field notes help the researcher stay in-tune to the various contextual factors that may be shaping the interviews (Charmaz, 2006). Field notes for this research were taken throughout the data collection phase to capture a wide range of contextual data. This data included interview setting; participants' demeanor throughout the interview; key words, phrases, or important themes participants touched on, and the interpersonal dynamics throughout the course of the interview.

3.4.3.3 *Reflexive Memos*

Memo writing is critical to the grounded theory process (Stanley, 2006). As Charmaz (2006) explains, "memos catch your thoughts, capture the comparisons and connections you make, and crystallize questions and directions for you to pursue" (pp. 72). In this capacity, memos facilitate ideas between the data collection and analysis phases and carries through to all subsequent phases of the research.

Reflexivity refers to the researcher's critical thought processes regarding their study (Charmaz, 2006). Reflexive memo writing becomes an opportunity to monitor the researcher's feelings and perceptions in order to understand how they are influencing the

data collection process. For Finlay (2002), reflexivity "involves a shift in our understanding of data collection from something objective that is accomplished through detached scrutiny of 'what I know and how I know it' to recognizing how we actively construct our knowledge" (pp. 532). Engaging in reflexive memo writing is essential to a constructivist approach to qualitative research as it develops the researcher's self-awareness and explicates how the knowledge is being co-created.

Reflexive memo writing was used consistently throughout the research process with a particular emphasis during data collection. Memos were written to capture the context and atmosphere of the interviews, my initial impressions, and identifying significant themes worth revisiting in the analysis. Memo writing allowed for a more nuanced understanding of myself as well as the participants.

3.4.4 *Analysis*

In grounded theory, a constant comparative approach is used (Stanley, 2006). As data becomes available, it is quickly analyzed for new ideas and emerging concepts. These new concepts can influence data collection either through the way interviews are conducted or through the sampling strategy. Through a rigorous, iterative, and creative approach to analysis, a co-constructed theory that explains the social phenomenon of interest emerges (Charmaz, 2006). The following will discuss the methods used to help develop my grounded theory and explore women's and obstetrical care provider's experiences with household chemical risk.

3.4.4.1 *Coding*

Coding is defined as the act of categorizing, defining, and theorizing segments of qualitative data (Charmaz, 2006). The researcher engages in an interpretive process that

shapes the data and gives it meaning within the context of the project. Coding occurs in two broad and interrelated phases: initial and focused (Charmaz, 2006). In initial coding, data is examined (word-by-word or line-by-line) and compared against other data in order to explore all ideas, insights, and theoretical possibilities. Through initial coding, the investigator's general impressions of the interview are challenged creating opportunities for meaningful analysis to occur. Focused coding takes the most salient codes arising from the initial phase and re-organizes the data under them (Charmaz, 2006). Focused coding is also the first step towards theoretical integration and theory creation.

The data analysis process closely followed the process outlined by Charmaz (2006). Each transcript was independently coded by myself and one other researcher. Each transcript was read in its entirety to determine what was said before engaging in initial coding. Analysis was supported by NVivo 9^{TM} qualitative software. Transcripts were broken down into their initial codes and compared against each other. At first, transcripts from pregnant women and obstetrical care providers were kept separate. As salient codes developed, the groups were compared against each other for a more refined understanding of the data. After initial coding, the researchers met and determined the salient codes that would comprise the focused coding phase. The focused coding phase involved revisiting the transcripts with the higher level coding scheme. Throughout the coding process, field notes and reflexive memos were used as reminders of my initial impressions of the interviews. They were also used to foil new understandings and to think critically about emerging theoretical directions.

3.4.4.2 *Analytic Memos*

During data analysis, memos act as a medium to define, challenge, and refine codes, categories, and concepts emerging from the data (Charmaz, 2006). In doing so, the research process remains active, creative, and engaging for the researcher. Writing about focused codes requires a more abstract thought process allowing the relationships between codes and thematic categories to emerge. Alternatively, exploring focused codes in memos may expose gaps in knowledge and encourage more data collection (Charmaz, 2006). Collectively, memo writing pushes the data to more abstract levels allowing the investigator to develop a theory that best fits the data.

Analytic memos were written extensively throughout the analysis. During initial coding, memos were often written to describe emerging codes and consider relationships between them. As the analysis reached the focused coding phase, the memos were used to explore the theoretical relationships between these codes. This involved diagramming relationships between codes with brief notes regarding the function of these relationships. I found this helped deal with the abundance and complexity of initial codes. The preliminary theories in these memos were constantly compared against each other as well as new data as it became available. Through adherence to the memo writing process outlined by Charmaz (2006), the codes matured to theoretical categories which best served my interpretation of the data and the subsequent theory.

Memos were also used as an opportunity to be reflexive about the analysis and understand how, as a researcher, I was shaping the data (Charmaz, 2006; Finlay, 2002). The memos often dealt with representing the participants' thoughts and perceptions honestly and understanding how my experiences influenced my perceptions. Of particular concern were my perceptions of the risk of phthalates and other household chemicals in

relation to the participants'. I found my understandings of the risk shifting throughout the interviews depending on how the women or health care provider framed their perceptions. Ultimately, this helped me develop an appreciation for the social constructions of risk and limits of probabilistic risk calculations.

Finally, memos were compared and discussed amongst the research team in order to gain an appreciation of each other's understandings of the data. This was an opportunity to confirm interpretations of the data as well as challenge each other's theoretical directions. Through this, conflicting assumptions and understandings of the data were revealed and, through dialogue, were resolved. This process allowed for a rich and detailed understanding of the results.

3.4.5 *Ensuring Quality*

A considerable amount of work has gone into identifying what constitutes high quality research and many scholars have offered criteria they believe capture a quality study (Morrow, 2005; Whittemore et al., 2001). However, no set of criteria has sufficiently addressed the diversity of qualitative research nor been widely accepted as standard (Whittemore, et al., 2001). Probably the most widely known set of quality criteria for qualitative research is Lincoln and Guba's (2000) criteria of trustworthiness. Lincoln and Guba have argued for four criteria that are parallel to the quality criteria used in quantative research. For example, transferability, whether or not the findings apply in other social contexts, parallels the quantitative criteria of external validity. Although parallel criteria may provide a sense of continuity between quantitative and qualitative research (Lincoln & Guba, 2000; Whittemore et al., 2001), these criteria are heavily situated in positivist research paradigms which ultimately excludes other forms of

qualitative research (Morrow, 2005). Charmaz (2006) outlines four criteria (Credibility, Originality, Resonance, and Usefulness) that, taken cumulatively, point to a high quality constructivist grounded theory. These criteria were used as the basis of assuring quality throughout the research process.

Credibility is concerned with fundamental aspects of the research. Has the research achieved a full understanding of the topic? Was the analysis systematic and comprehensive? Was there sufficient evidence to support the results and subsequent analysis? The credibility of the grounded theory was established primarily by closely adhering to constructivist grounded theory methodology (Charmaz, 2006). For example, the literature review was complimented with extensive memo writing; a strategy recommended by Charmaz (2006) to promote familiarity in one's field without developing preconceptions that may influence analysis. This allowed me to develop sensitivity to the leading scholarship in the field while remaining open to potential divergences in my work (Charmaz, 2006). Other strategies included field note taking to familiarize myself with the research setting and consultations with my research team for critical feedback regarding my ideas, theories, and arguments. The multiple strategies discussed work together to help establish a credible grounded theory of women's perceptions of household chemical risks.

The second criterion, originality, addresses the novelty of the grounded theory and the contribution the research makes to the literature it is situated within. By reviewing the pertinent literature regarding risk and motherhood as well as addressing a current gap of knowledge regarding household chemical risks, the unique contribution of this research was made explicit. By reviewing phthalates science in conjunction with

feminist literature and risk research, opportunities for new theoretical relationships and understandings were made. Moreover, as will be demonstrated in later chapters, the results emerging from this grounded theory will be shown to resonate with current thought regarding motherhood and risk. The results will also be brought into dialogue with other relevant literature which will create another opportunity for new insights and theoretical connections. By identifying a gap in the literature and explaining how the subsequent results address this gap, this research project aims to meet Charmaz's (2006) originality criterion.

Charmaz's (2006) third criterion is resonance. Here, how fully the results capture the lived experience of the participants is considered. How is context captured in the theory? Do the results honestly portray the experiences of the participants? A common method used in qualitative research to ensure resonance is member-checking; the process of sharing transcripts and results with your participants to verify an accurate interpretation of the data (Charmaz, 2006). However, given certain logistical and time constraints particular to the research team, member checking was not an appropriate strategy for this project. Instead, other strategies were used to achieve resonance. Specifically, I had the opportunity to share preliminary results with other mothers as well as the obstetrical community.

Presenting my work at the Schulich School of Medicine and Dentistry's 9th annual obstetrics and gynaecology research day was particularly valuable. Receiving feedback from obstetrical care providers who work in the context I studied helped address the strengths and weaknesses of results and what improvements I needed to consider. Some of the women who viewed my work were also able to engage with the theory as mothers.

These women were able to affirm particular interpretations and challenge others. This was an important piece of the co-construction of knowledge. Through this engagement, I ensured my findings would be relevant, accurate, and represent the lived experiences of my participants.

The final criterion, usefulness, looks to identify the applicability of the results and the contribution this work offers to improving society. It should be mentioned at this point that the small sample size and qualitative approach of this study prevents any statistical generalizations to made (Charmaz, 2006). However, this does not diminish the utility and contribution this work can make to the academic community and society overall. As suggested before, knowledge of household chemical risk is becoming an increasingly significant source of anxiety for women (Altman, 2008) with implications for the care clinicians provide. Studying this problem through a constructivist lens acknowledges the contribution of both women and obstetrical care providers in shaping the context in which these risks are experienced. Accordingly, this study realizes and embraces the fact that the results represent one potential interpretation of many. This welcomes women, clinicians, policy makers, and researchers to engage with this work and each other, to discuss their experiences, and come to new understandings. Through discussion and knowledge creation, then, the usefulness of this study is established.

By attending to Charmaz's (2006) four quality criteria, I hoped to develop a grounded theory that is credible, original, relatable, and useful. A particular criticism of these criteria is the onus on the individual to assess the quality of the work. Personally, I find this a particularly attractive characteristic of Charmaz's work. These considerations force readers to engage with the material and take part in the co-construction of

knowledge process. In doing so, the work stimulates discussion and points to further areas of inquiry. It is my intention that pregnant women, obstetrical care providers, and others can connect with my work and find it meaningful.

3.5 Ethical Considerations

Participants were given a verbal description of the research as well as a written description of the research to keep. Written informed consent was obtained by myself or another member of the research team before the interviews began. Participants were informed that they were under no obligation to answer any question and could withdraw from the interview at any time. All interview tapes, transcripts and field notes were removed of any identifiers to maintain confidentiality. Moreover, consent forms and tapes were kept locked in separate cabinets in the primary investigator's locked office. Ethics approval for the study was sought and gained from Western University Health Science Research Ethics Board.

3.5.1 *Vulnerable Populations*

Broader ethical issues involved the status of pregnant women during the interviews. According to the Tri-Council policy statement (2010), pregnant women are considered vulnerable populations. Extra attention had to be given to ensure that they were not exploited for the purposes of the research. This made obtaining written consent from women particularly important (Tri-Council Policy Statement, 2010) as well as paying particular attention to the social dynamics of the interview. The research team was sensitive to how women responded to questions and was careful not to move the interview into potentially uncomfortable areas. The use of reflexive memo writing was also particularly helpful in developing sensitivity to these particular scenarios. However,

attention was given to researcher-participant dynamic in order to respect the participants time and be appreciative for their insight.

3.5.2 *Risks and Benefits*

Participants were exposed to very few risks during the course of the interview. There was the chance of the interview recalling unpleasant memories leading to emotional distress. This was unlikely, however, given the nature of the prompts and the intentions of the interview. Another concern was the potential stress or fear that could arise due the discussion of phthalates or other household chemical risks. This was hopefully minimized through two approaches. When information was given regarding phthalates, the research team went to great lengths to indicate little is still known about the risks of phthalates and current research points to their safety. Secondly, an information brochure about phthalates was offered to the participants to take home. Participants were also given a phone number to a confidential voice mail box where they could voice any questions or concerns regarding the research.

3.6 Summary

Little is known about how women perceive, understand, and respond to ill-defined risks such as phthalates. Accordingly, this study sought to develop these understandings qualitatively. Obstetrical care providers were also studied in order to gain insight into how expert discourses shape women's experiences. The study subscribed to a constructivist grounded theory methodology as described by Charmaz (2006). Data was collected through semi-structured interviews, field notes, and reflexive memo writing to capture the content, context, and emotions of the research. Analysis relied on initial coding, focused coding, and analytical memos to develop concepts and categories and

develop an emergent theory from the data. The use of Charmaz's four quality criteria served as the foundation for which quality was assessed throughout the process. The elements of this study provided a strong and coherent basis to explore women's understanding and experiences of phthalates. The findings from this study will be discussed in the next chapter.

4 RESULTS

4.1 Introduction

A constructivist grounded theory study (Charmaz, 2006) was designed to explore pregnant women's (PW) and obstetrical care provider's (family physicians [FP], midwives [MW], and obstetricians [OB]) perceptions of phthalates. Pregnant women and obstetrical care providers were interviewed to gain insight into professional discourses of risk and understand how their perceptions may influence women's understanding phthalates. The following will present the results of the study.

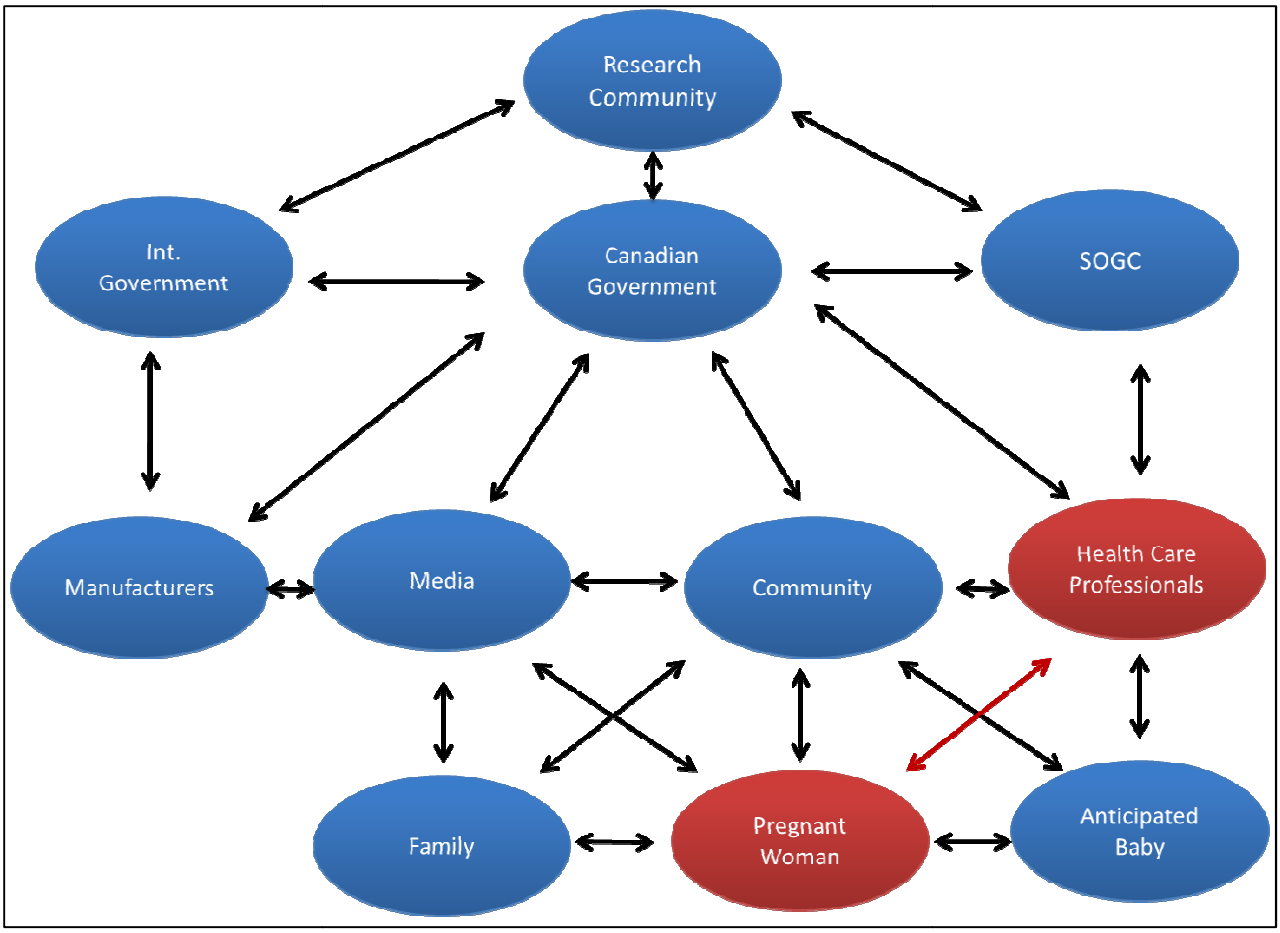
Two complimentary and interrelated models emerged from the data. The first model, Relationships in Pregnancy, illustrates women's and obstetrical care provider's perceptions of salient relationships during pregnancy (Figure 4-1). The second model, Decision Making in Pregnancy, depicts how pregnant women receive, evaluate, and act on information during pregnancy (Figure 4-2).

4.2 Model One: Relationships in Pregnancy

Figure 4-1 models the salient relationships participants identified during interviews regarding their experiences with risk and pregnancy. These relationships influenced women's and health care providers' experiences, understanding, and perceptions of risk. The pregnant woman-clinician relationship was identified by both pregnant women and health care professionals as the most significant relationship regarding risk in pregnancy. Participants felt that this relationship was where women could receive grounded information regarding risk in pregnancy. While women expressed a concern about household chemical risks, including phthalates, the clinicians did not perceive them as a legitimate risk to pregnancy and did not include it as a part of their

prenatal counselling. Clinicians explained their lack of concern of phthalates as a result of a lack of guidelines from their governing bodies (Relationship 2). Other relationships were identified and added to the Model to demonstrate the complexity and social connectedness of the pregnancy experience, especially in terms of risk.

Figure 4-1: Relationships in Pregnancy



4.2.1 *Context of Interviews*

Model 1 was developed from analyzing the interviews conducted by Dr. Sharma and myself with my role largely focused on taking detailed field notes and helping to modify the interview prompts to better suit the nature of the interviews. During this

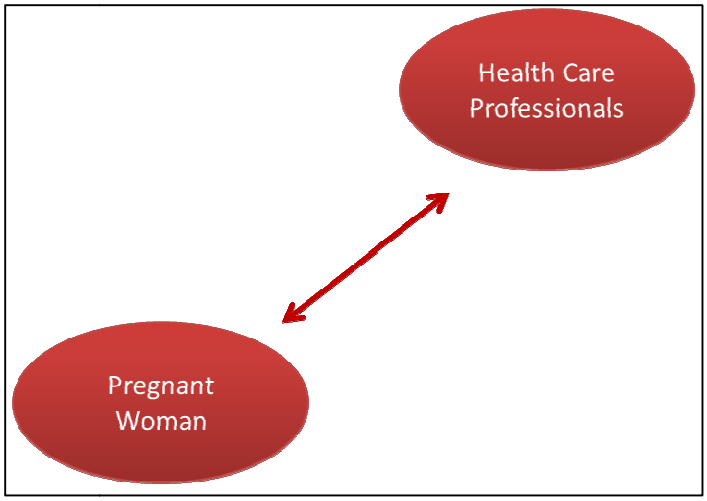
phase, 11 pregnant women and 11 obstetrical care providers (6 obstetricians, 3 family physicians, and 2 midwives) from Southwestern Ontario were interviewed.

Clinicians were interviewed in their offices or at a mutually agreed upon location. Although these settings allowed for a focused and polite conversation, the interview often had a very professional feel. It often became difficult to overcome this professional barrier and discuss salient issues on a more personal level. This was particularly true when interviewing the obstetrical care providers. Overcoming the professional tone of the conversation often proved to be difficult and was an important aspect to consider during the analysis.

Most of the pregnant women interviews were conducted in a vacant examination room at general practitioner clinics and hospitals. Although women were more comfortable with disclosing personal experiences and feelings regarding risk and pregnancy, there also seemed to be some hesitance to be fully open. This is not surprising given the personal nature of the discussion and minimal time to develop a rapport.

4.2.2 *Relationship One: Pregnant Women and Health Care Professionals*

The central relationship invoked during the interviews was between obstetrical care providers and pregnant women. Both pregnant women and the clinicians acknowledged the value women placed on their health care professional to provide reliable information regarding risk.



PW-3 justified her trust in obstetrical care providers by invoking their professional and social duties:

> *I would believe that the healthcare provider could help give an insight to it if, ah, no one else is, because the healthcare provider's role is to maintain your standard, right, and keep you healthy in and unfortunately that's the only person that's going to be able to do it then*

Similar sentiments were offered by PW-5:

> *I'd rather them, yeah, tell me everything, honestly too, you know, and then I also think too though that if they know it will harm then it's, they're responsible to inform us and to direct us to take that harms out of way, cause what's the sense of growing someone not to their full potential, I don't get that, why would you shorthand your people, like*.

For PW-9, she relied on her physician the most for information rather than accessing less formal sources of information:

> *My doctor, I don't really ask anybody else, cause my Mom's old, and she says she doesn't remember, so, it's either my doctor, or, like my friends have kids so I ask*

my friends if I have questions, but usually in between seeing her it's the Internet, my friends.

Some of the women made a slightly different point. For these women, meeting with their obstetrical care provider was an opportunity to learn as much as possible about risks and determine what is relevant within the context of their own life. As PW-3 explains:

Well, I think that we should have the opportunity to know everything that you would, say, a drug that a doctor's prescribing you. Um, or a procedure that you're going to have done, you should be able to make the informed decision on your own instead of having it forced upon you.

The same ideas were also invoked by PW-11:

I think their role is very important and they need to tell you everything even if you, don't want to hear it or you're nervous to hear about it, I think you should be told every kind of risk because they don't know exactly your living environment is, or what you do, where you go, people you're around with.

Notably, PW-4 claimed to be less reliant on her obstetrician to provide information regarding risk in pregnancy and placed the responsibility on herself:

I believe you should be researching it yourself because your obstetrician doesn't have time to know, like, everyday products that you are using, which brand of product, and to be researching everything herself...

Obstetrical care providers were also quick to acknowledge the importance of their role regarding risk in pregnancy. As FP-1 explains:

> *I think even though a lot of people go to the information, some of them might, I would say the vast majority still come with the confidence in their doctor to give them a kind of a grounded perspective, um, because things on the Internet, I think a lot of these women know, um, can be, um, inflamed or minimized.*

Physicians often chose not to speak about household chemical risks such as phthalates as a result of a lack of knowledge. FP-2 commented:

> *Well I think there are some items like, you know, strong, strong cleaners, acids, alkalines, things that could pose risks to, to people in general including pregnant women. Um, I, I appreciate what you just told me but I honestly don't know enough about them to say for sure that, that these things should be avoided. I'd certainly want more information.*

Similar ideas were offered by OB-5:

> *Yeah, I think if there's data, I think presently there isn't that much data on environmental risks and early fetal development so I'm not sure that, that you can talk in detail about environmental risks, I'm not sure that there are that many links with, ah, fetal development.*

OB-1 rationalized the choice to not discuss these risks in light of the potential anxiety women may experience during their pregnancy:

> *And, until there is a good alternative I'm not sure how much we should stress our pregnant patients out because they're afraid everything when they're pregnant. I'm not sure we could go and tell them not to use their Blackberries, their work depends on it…*

When health professionals acknowledged the need to discuss these risks, they were quick to shift responsibility to others. For example, OB-2 looked to the family physician to provide information regarding phthalates in pregnancy:

> *By the way, we generally don't get to see patients until they're 32 weeks pregnant or later on in their pregnancy, at least half way. So I think this should really be a general public education or family physician education rather than obstetrician because of the late referrals*.

Alternatively, OB-4 argued that it would be unfair to expect family physicians to provide information regarding household chemical risks given their extensive work load:

> *I think the onus should be on our SOGC, or federal or provincial guidelines. I mean, if there is a chemical out there that has been proven in science literature that poses a risk to the baby we all should be aware of it, um, and I think that going through the media and probably exposure is the best way rather than individual GPs, individual GPs. They've got so many things on their plate they can't be aware of any, sort of, potential exposure or risk factor with pregnancy in the first trimester…*

OB-1 felt that midwives would probably have the most time and resources to educate women regarding these risks:

> *The more people you put in your clinic the less you're going to tell them. Ah, so midwives spend a lot more time, I suspect, discussing a multitude of issues, but they get reimbursed to do that. It's not that there are OBs that still don't want to do that, it's that the current structure doesn't allow it. There's no room for it.*

How can you spend half an hour with each patient? It's not purely just a financial thing…

However, Midwife (MW) 2 expressed doubts about her ability to provide information during antenatal care:

I don't know if midwives would be the best to do that because again we don't see a lot of people. But actually we can do a postpartum.

Both women and obstetrical care providers perceived their relationship as fundamental to negotiating risk and achieving a healthy pregnancy. Women expressed an expectation to receive as much information as possible regarding risks in pregnancy from their clinician. Women felt their physicians did not have enough insight into their lives to determine what was ultimately relevant. Conversely, obstetrical care providers were hesitant about providing information about all risks, especially those concerning household chemicals. Although most health care professionals agreed that phthalates were likely a cause for concern, the lack of data prevented them from incorporating it into their practice.

MW-1 gave a very telling anecdote that exemplifies the tensions in the pregnant women-obstetrical care provider relationship. At the beginning of the interview, MW-1 claimed to be aware of the mounting evidence for household chemical risks and discussed the steps she takes to reduce her own exposure. However, MW-1 said she rarely provides counseling on these risks unless prompted by women. Around the time of the interview, MW-1 had a patient inquire specifically about phthalates. This put MW-1 in a precarious situation. As she explained:

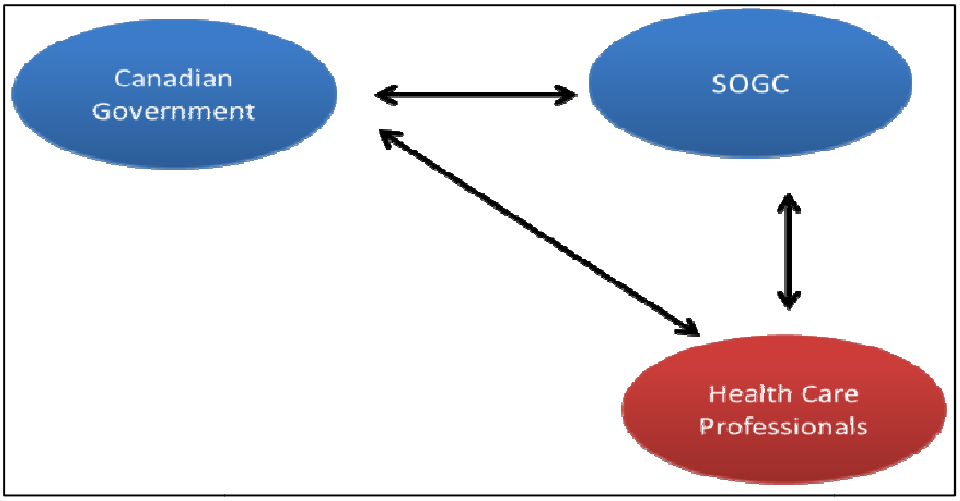
> *Yeah, but it was very, like it was just, that [phthalates] specifically. Like that's the way it was phrased…How do I avoid phthalates? She was really concerned about it…I was a little bit stumped about where to direct her, um, in terms of, you know, how do you, cause her concern was that she would have to turn her whole life upside down and really would struggle with how to, try to eliminate, and her concern was, what if they are already in me, right? And how, like what do I do not kind of a thing. And it was really not something I could answer for her at the time*.

MW-1's experience exemplified the difficulties obstetrical care providers discussed regarding providing counselling on household chemical exposures. Even for a person who expressed concern about the impact of the environment on human health, MW-1 felt limited by the current state of knowledge regarding phthalates to provide meaningful guidance.

These tensions sent me back to the data for more insight into how and when obstetrical care providers felt confident in providing counselling risks in pregnancy. These relationships will be explored next.

4.2.3 *Relationship Two: Healthcare Professionals and their Governing Bodies*

For clinicians, professional governing bodies like the Society of Obstetricians and Gynaecology (SOGC) and Health Canada were relied on to provide information regarding these risks before they incorporate it into their practise.



FP-2 gives a general explanation of this sentiment:

> *I'm sort of more influenced by, um, the studies and the, ah, the experts that promote them, I guess, so I, I wouldn't, you know I'm not as impressed with a P value because lots of things can have a P values associated with them but, if somebody that I think is very credible points to a risk then that's, that's something I would take notice of and influence my patient education.*

FP-2's remarks suggest that clinical practises are influenced by evidence, especially studies that are accepted and enforced by governing bodies. MW-1 offered insight into what would make her more confident in providing counselling:

> *Um, and there's nothing necessarily there supported by Health Canada or supported by the Society of Obstetricians, so, I think for me it would make me feel much better if we had a reliable place to send women when they have concerns…*

For OB-4, the SOGC was an important place to learn about risks before incorporating them into practise:

> *Oh, so you're talking about phthalates, okay…um, I'd probably go with our SOGC being the first line, our, ah, recognized body that does a thorough medical-*

science research and then that certainly can be relayed through the media, government, etc., etc. But I think the SOGC, um, would be our body I'd probably listen to…

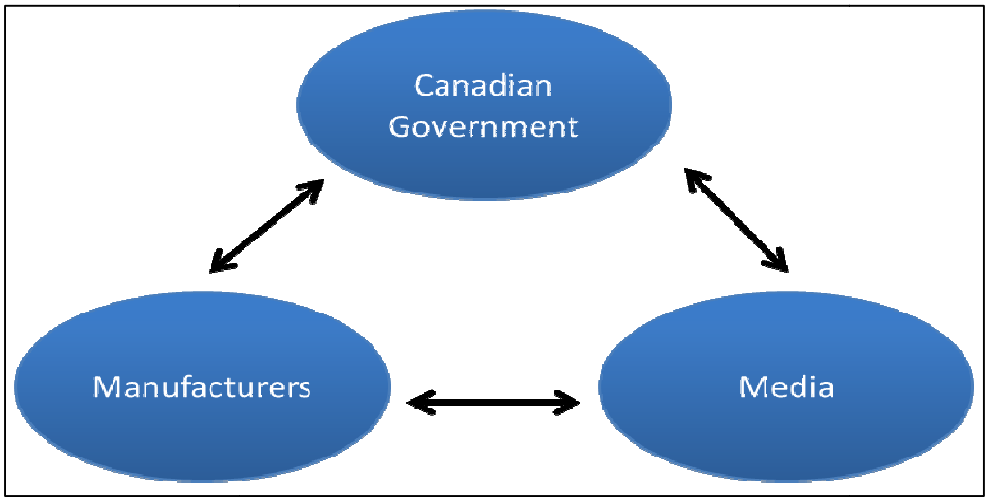
FP-3 specified other important institutions along with Health Canada and the SOGC as significant sources of information for practise:

So it comes in your continuing medical education. So that may come from Health Canada, that may come from SOGC guidelines that may come from the Canadian Family Physician, that may come from our Mother Risk stuff that often has a published, um, is usually a couple of pages about one item in the CFPC every month. So I think that those would all be places where you can information on…

The data presented above begins to offer insight into one of the tensions between the obstetrical care provider and the pregnant woman. Obstetrical care providers' relationship with their governing bodies seems to hold significant influence into what clinicians include in their practise. As it stands, little is offered by Health Canada or SOGC regarding phthalates or how to approach household chemical risk in practise. Not surprisingly, the clinicians interviewed claimed not to discuss risk of phthalates in their practise. Ultimately, these quotes demonstrate relationships can indirectly impact the Woman-health care professional relationship.

4.2.4 *Other Relationships*

Other relationships were mentioned by participants during the interviews. However, participants were often unsure about what could reasonably be expected from them. Some participants even expressed distrust in some institutions such as the media, government, and manufacturers.



PW-5 was particularly critical of the media and the Canadian government. PW-5 on the media:

> *So they'll tell you whatever to scare you away from one person's stuff and say, oh, ours is wonderful, you know, but I don't, you don't really find places that just tell it as it is, you know, except for Wikipedia and Google, but again, like I said with Google you know, you might click the third one down and the two above might have more information, you never know, so it's still kinda bits and pieces.*

PW-5 on the Canadian government:

> *And I think that everybody agreed with, like, you know, if Canada would stand up and say no, our people deserve better than this, then they would be able to say, you know, our babies deserve better than this cause Canada's standing, Canada's saying no, like.*

Other women were conflicted in their expectations. PW-8 tried to give the government the benefit of the doubt regarding a lack of phthalate policy. However, her comments seemed particularly skeptical:

> *As it pertains to this, um, that the government would make an educated decision based on information, if they were aware of it…um, I don't understand if they've banned it in Europe and they banned it in the United States why it wouldn't be banned in Canada. It doesn't really make sense to me. Obviously they've made an educated decision it's not a good thing to have around, so…*

PW-1's comments implicated the government, the research community, and manufacturers in researching the risk of phthalates:

> *I think that there should be studies going on, and government giving money to studies to make sure we can reduce the risk of any problems down the road, I think the manufacturers as well should be involved in researching the products they use, although there could be bias there. I think they should be involved.*

FP-1 and FP-2 both had similar sentiments regarding environmental policy development and the multiple parties involved. As FP-1 explains:

> *I think, that's the government responsibility, with of course input from, um, from the researchers and the manufacturers and other interested groups which could include physicians and healthcare providers.*

MW-1 expressed concerns about the role the media may play in disseminating knowledge of phthalates to women:

> *So I can appreciate that the media as a source, in that sense, of spreading the word, um, so I would hope that if, if there was something concrete to be said about the chemicals that we're talking that, you know, hopefully the same thing would happen, but then again back to if there was like a source that we could go to.*

OB-6 had difficulty assigning any one party with the blame of exposing women and the general public to phthalates. The responsibility of the consumer to be knowledgeable in their purchases was identified:

> *Oh, that's difficult to say. I mean, I guess if anybody the manufacturers, but it, again people make things and you don't know the effects of them for a long time, and so I'm not so sure that, you know, it's buyer beware as well, right, like you don't know a lot of, you can't assume that everything is, ah, is safe*.

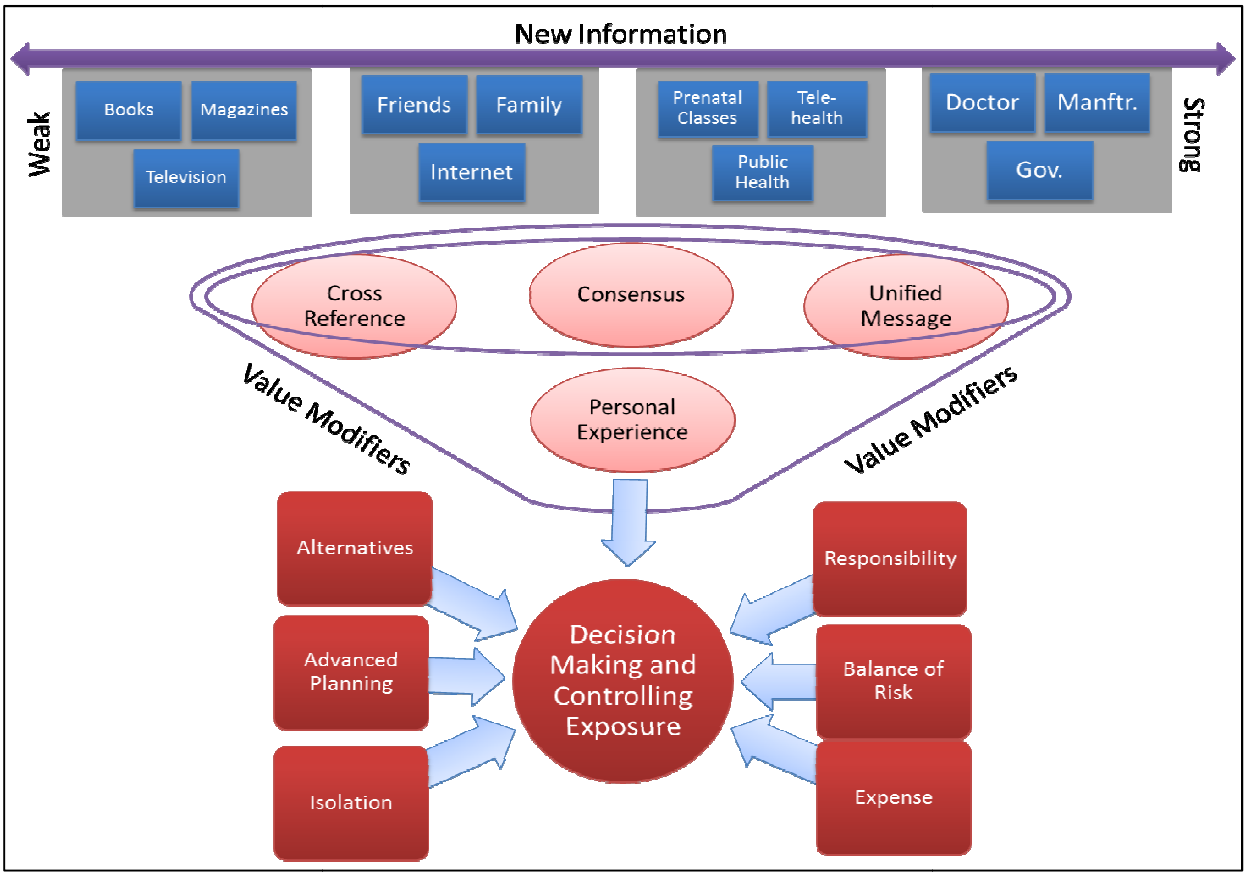
As women and obstetrical care providers reflected on other social groups related to household chemical risk, their responses were often vague and conflicting. However, what certainly seemed clear was that participants felt that these institutions did play some role in taking action against and providing information regarding household chemical risk and phthalates. Accordingly, the various relationships mentioned in the transcripts were subsequently added to the model which fleshed out the understanding of women's social networks during pregnancy.

4.3 Model Two: Decision Making in Pregnancy

The second round of interviews aimed to fill in the theoretical short comings of the first model. The emergent model described how women perceive risk information and subsequently make decisions. Women discussed receiving new information regarding pregnancy from a wide range of sources existing on a continuum of perceived weakness and strength. Strong sources were considered more legitimate than weak sources but their inherent value could be augmented by four value modifiers (Cross referencing, Consensus, Unified Message, and Personal Experience). Women took on the responsibility to make decisions regarding risk during pregnancy and used various tools

to do so (Decision Making and Controlling Exposure). Ultimately, the second model depicts the complex ways women receive, perceive, appraise, and act on a wide range of risk information in pregnancy.

Figure 4-2: Decision Making in Pregnancy



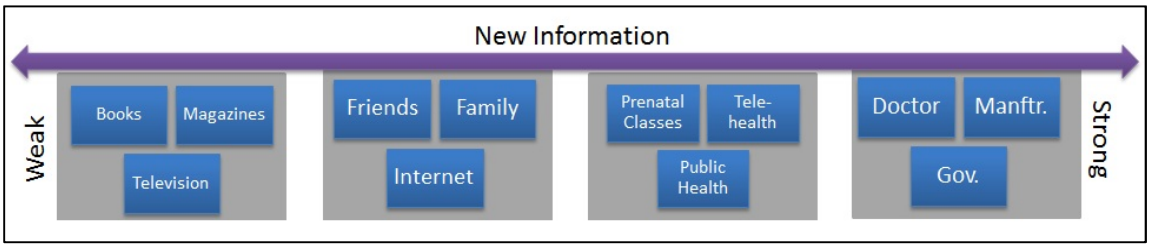
4.3.1 *Context of Interviews*

Twelve pregnant women participated (six from Chatham and six from Walkerton) for this round of interviews. The interviews were conducted by myself and another member of the research team. Many of the interviews were conducted in the same context as the previous phase. The interviews occurred either before or after the women's appointment with the family physician in an empty examination room or office. Participants were generous with their time, enjoyed the interview, and were interested in

learning more about phthalates. PW-15 was particularly interested in the research and seemed enthusiastic to learn more about our goals and the emerging results. The enthusiasm of the participants gave the interviews a more casual and relaxed feel as opposed to the more professional atmosphere of the first phase.

4.3.2 *New Information*

Women discussed accessing a wide range of various information sources about risks during pregnancy. However, for these women, information sources regarding risk in pregnancy were not considered equal. The different information sources were perceived by the women to have inherent value which existed on a continuum between weak and strong. Most of the women described books, media, friends and family as weak sources for information on risks in pregnancy. Strong sources included physicians, the government, and manufacturers.



Regarding weak sources of information from the media, PW-15 commented:

> *We need a good source to find out about something but I don't use anything of the media to portray the fact. But it's a good way to spark my interest on something so if I read it in an article or something, oh that's interesting, but I'm not going to take what they had as the gospel.*

PW-14 discussed how she appraises risk information on the internet with a skeptical approach:

> *Yeah, um, well I try and find Canadian ones that may be more relevant to me. Um, but I try and avoid those ones that are just random people…I try to look, like if they're a medical source*.

Although family members were often relied on for information in pregnancy, they were considered relatively weak sources on which to actually base decisions. PW-20's comments highlights this sentiment and offers insight into women's thought processes when making decisions:

> *My husband brought up, maybe something in the diapers, I think we heard somewhere that a product in the diapers could maybe be increasing prostate or ovarian cancer or something like that. So that got me thinking maybe we should go to cloth and all…but I haven't seen it anywhere, or just in a conversation hearing that from someone…I guess that's kind of a selfish thing but it's just more convenient, I guess to have the disposable ones. And because I haven't heard anything aside from someone's opinion, like, I think it came up in a conversation, I haven't heard anything to back it up. So I haven't thought about it further…*

PW-12 explained how her friends' experiences of pregnancy helped PW-12 identify a particular complication she was experiencing:

> *Um, I think I use people [as sources of information], so other women that have been pregnant, not necessarily in my profession, but just other women that have been pregnant, saying, you know, what do you think of this, or how did you, how did you encounter that, or how did you make it through that? That's a lot of experience. Like right now I'm being tested for, um, for cholestasis…But it's less than 1% of all pregnant women that get it, but I only recognized the symptoms*

because she had told me about it so it's kind of, just the historian of other people that helps, yeah…

The women considered strong sources as coming from more authoritative bodies in society. Consistent from the previous round of interviews, obstetrical care providers as well as other health professionals were regarded as important and particularly strong sources of information. As PW-14 comments:

I think things that are proven, that they know for sure, and even when they have an inkling that it could be something that they should, say there is a chance that this could affect the baby, it would be very nice of the doctor to bring that up but I know unless it's proven they're probably not allowed to say that…

PW-18 considered public health boards to be knowledgeable about risks in society are and inform the public:

The public health I think should be there by the, provide the information on everybody's general health, whereas my doctor is specifically for me. And this would be something for, like, everybody's general health.

Some participants felt that manufacturers and the government make implicit claims about a product's safety by allowing the product to be available for purchase. PW-21 explained:

Like, I would, if there's a product in the shelf in Canada I would think it's safe to use. Like I shouldn't have to take it [laughs] everything I buy and say, is this safe or what. I don't and maybe I should question more but I don't. I just take it for granted that…

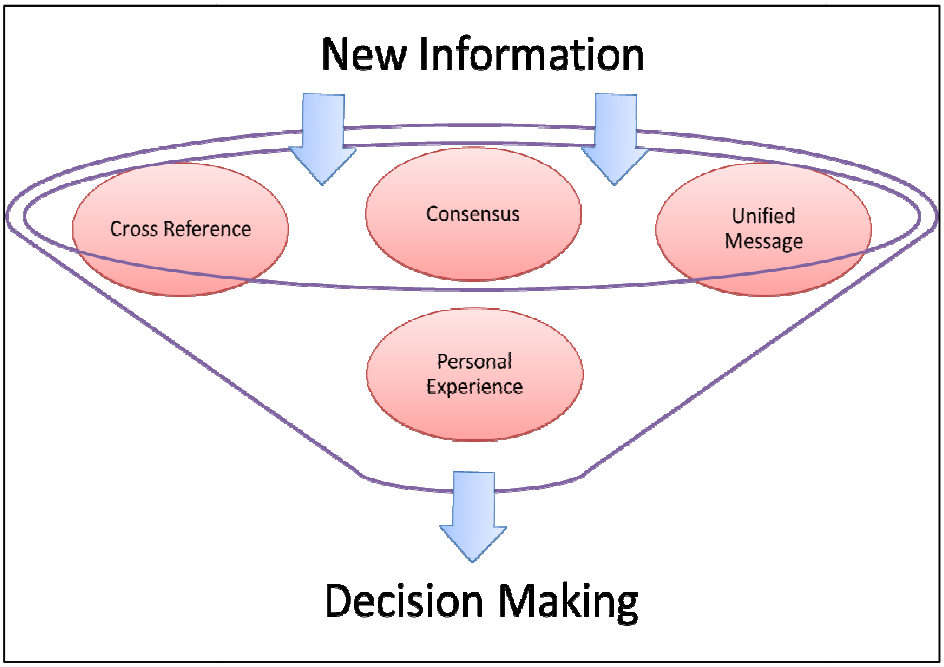
Similar sentiments were offered by PW-12:

Yeah, yeah, I do remember hearing that. So definitely if they pulled other things already then obviously there's a, there's something going on there. Why haven't they pulled them off everything? There's probably not enough, like you said, research to back it up yet.

The perceived strength of a particular information source influenced how seriously a risk claim was considered and subsequently be a part of the woman's decision making framework. Indeed, strong sources were considered more likely to be acted on by women than weak sources. However, the inherent value of an information source could be modified through various processes.

3.4.3 *Value Modifiers*

Four broad value modifiers emerged from the analysis: cross-referencing information sources, developing consensus amongst sources, seeking a unified message, and personal experience.



Cross-referencing information sources was one of the more frequently discussed methods women used to ensure the information they were receiving was worth considering. Weak sources were often cross-referenced with strong sources before it was seriously considered. PW-13 discussed how she would check information she read on the internet with her physician:

> *Um, I'm usually just, like, happy with what the doctor says but if it was something that I'd read on the Internet then I would, that's something I would ask the doctor about it, but if the doctor had said it in the first place I wouldn't go check on the Internet*.

PW-17 also claimed to check information she learned from Tele-health with her physician:

> *I just wait if I don't know. I usually call Tele-health if I want to know stuff. Um, oh, they can be, very really helpful or overly useless. So it's one extreme to the other. But it's worth a shot. If you go to the doctor's the next day and they say a completely different thing then you just wasted your time trying to do that…*

Upon hearing media coverage about the health effects of the endocrine disruptor Bisphenol A (BPA), PW-19 was unsure whether or not she was going to buy new bottles until they were officially recalled by manufacturers:

> *That was like, my baby…but there might be something wrong, or, yeah, that was the tipping point when they… so when I hear hype and I'm like, oh, it's, just, you know, the story of the week, but when the manufacturers are starting to recall and say well maybe it's not the best idea…*

Women felt that the inherent value of weak sources could be strengthened when vouched by strong sources. Indeed, this was seen as an ideal method for many of the pregnant women to receive information regarding risk. This sentiment was captured by PW-20's comments:

> *Maybe even to be given a resource that they trust would be good, like a, like if they have…a book that they could recommend, that would be helpful because they don't have a lot of time to go over everything*.

PW-22 stated:

> *Well I find my doctor basically says what I, what I think, like he'll support the, what you hear on the news, right, they're immunizing for this, and yes it's important or no it isn't. It's important for them to be the same, and if they weren't' then I would ask friends, ask around…*

PW-15 expressed a desire for the government to create and endorse a website that provides feedback about risks and the current level of concern:

> *If the person has the choice, if they go [online] the government resource or whatever maybe, and there was, like on the horizon, like low risk, right now, you could at least look at that and see…*

Other strategies women used involved seeking a consensus amongst sources of information. This often pertained to internet searching as women tried to make sense of information on their own. For example, PW-13 said

> *Um, yeah I do because I usually use more than one, I go to more than one, like I don't just take one person's word for it, if a lot of people… Um, just the amount of*

> *people, like, just if it's one of those websites where it's a lot of people explaining it then it's usually more believable than, you know*.

When PW-23 was asked how she makes sense of new information from the internet, she replied:

> *I don't know, I just go with, like a lot of them say the same thing, I figure they must be close to the same*.

PW-14 explained that she tries to find a balance when the information she finds online conflicts:

> *I usually look at a bunch of different ones [sites] and then from those like basically, like, you can tell which ones are one way and the other way and I kind of like to be in the middle*.

Developing a consensus amongst sources offered women an efficient way to quickly appraise new information.

Receiving a unified and consistent message regarding risk in pregnancy from strong sources was also considered important to the women. However, inconsistent messages from strong sources would potentially reduce women's confidence in the information they received. As PW-19 commented:

> *Cause there are so many mixed messages about everything in pregnancy. So, like one doctor one thing, another doctor says another thing, you obviously go with what your doctor says, but something like this where there's a unified message should come from a public health board or something like that, or even doctors*.

PW-22 discussed a similar issue regarding consistent messages between Health Canada and her physician:

Well, if my doctor said it I would want to know how he knows, but, I think on the news you hear that, yeah, Health Canada has issued a warning on this and then you'd ask your doctor about it and, yeah, you'd want them to be the same.

Finally, women's personal experience was often the most significant and meaningful method of appraising and modifying the value of new information. For example, PW-12's professional training as a regulated health professional made her comfortable with her ability to appraise online information effectively. PW-12 said:

[Being a nurse I'm] used to doing research papers and term papers so you get used to using Medline and PubMed and those type of things where you know where to find the information, whereas maybe your lay person might not know where to go to find information, might just plain Google and not realise some stuff that's not as relevant.

Women often recalled experiences of previous pregnancies as a powerful means of sorting through information. PW-22's comments captured this sentiment well:

Well it's, it's all useful, like, it depends, like the first one obviously I went through it all [information from the government] and then with the second and third [pregnancy] you kind of know… Right. Well like car seats. Nothing's changed with the car seats so you don't need that any more cause nothing's changed, or, nutrition, um, just sleeping on their back, like, it's still put them to sleep on their back. I mean ten years ago it was on their side, or…

PW-20 described being more relaxed about risk relative to her first pregnancy:

Um, again with my first pregnancy I was probably, like a 10 out of 10 worried about everything, like what can I eat, what can't I eat, um, you know, even if I

> *was, like just the gas cap off the lawnmower one day, and I was filling it up, and I got a little bit of gas on my hands, I went in to wash it off, and I was worried, Oh no!, I touched the gas, you know, and, um, just cause you're, you're not sure what can hurt the baby. And people were that's a little excessive…I have definitely calmed down in terms of how worried I am now.*

For PW-23, however, her experiences with loss during previous pregnancies had made her more risk aversive. As she explained:

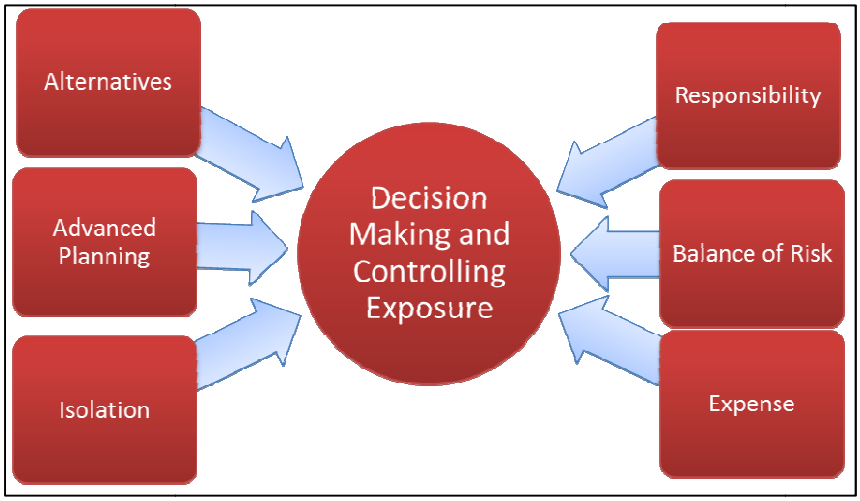
> *My first one I was, I was fine, like, I heard some horror stories but there's always horror stories, and then I got in a car accident and lost my second pregnancy. And then my third one was the gastroschisis and now this one I'm like something's going to go wrong, you know, I need to, whatever I did, I shouldn't do, I don't know, it's scary… I hate driving, I hate driving cause I'm scared that, you know, like if ever it comes out or, like, you know, I don't know, I hate doing anything, really. I'd rather just have the baby and that would be that.*

The four methods described above to appraise new information were applied idiosyncratically by women. If the information was deemed significant after this process, it would be subjected to another set of processes determining whether or not these changes were feasible to adopt.

4.3.4 *Decision Making and Controlling Exposure*

Women expressed receiving information from a wide range of sources and relied on various tools to determine the significance of the information they received. However, just because information was perceived as significant did not mean that women would

necessarily act on the new information. Women discussed the various ways they decided to act on risk information and control their exposures.



Balancing the costs and benefits of adopting a certain risk-avoidance behaviour was the most salient decision-making method. Other considerations participants balanced included the financial cost of risk avoidance against the assurance of safety.

Finding an appropriate balance was particularly difficult for PW-16:

> *Holy, I don't know. [laughter] I don't know, because, I mean, you need it, like you were saying, you need it on one hand…but on the other hand, you know, well I guess it should be known that there is a concern in regards to the chemical that is being used and leave it up to the individual whether or not, you know, let them, I guess, be known it's a risk…*

PW-15 and PW-19 both discussed the issue of balancing in terms of feasibility. As PW-15 said:

> *So people go over there [USA] and they and go, hey, let's get this bottle or whatever, if they can save 20 bucks, not on a bottle, be on any, if they can save 20*

bucks buying it in the States than they will but then how do we know if it still meets the same requirements as it does here in Canada and so on, right?

PW-19 said:

You're talking $5 versus $100 then, and if there was an unknown risk, then I would have to weigh that out, but if there was a known risk then, then how can you…you have to do what you have to do.

To effectively avoid household chemical risk, women discussed the need to have a lot of information early in order to plan in advance and find alternatives. PW-20 commented:

I would want to hear about it before I was pregnant, if I had the chance. Cause I would want to avoid it through the whole pregnancy if possible.

PW-15 said:

We haven't heard a lot about it but, what I have heard…I would at least try and position myself, if I'm looking at it as a possible issue, there's probably some evidence that's been brought up to have that research initiated, so, I'd probably try to avoid it from day 1.

Women were also quick to note that there were practical limits to the extent of their risk avoidance. This was especially true in relation to ubiquitous chemicals such as phthalates and BPA. PW-21 made this point rather succinctly upon reviewing the provided information on phthalates:

TVs can't avoid them, computers, can't avoid them, can't avoid really any of those, carpets, furniture, kitchen appliances, you just, they're there.

PW-16 said:

Ah, you know what, I find, you know, in this day and age that just about everything could be of concern anyway, and you know, the things, you know, we don't know, I guess, kinda of hard to avoid everything, I guess, especially if it's in your, you know, daily living, you know, the exposures, so. Kinda hard.

For PW-20, acknowledging a lack of control over every day exposures helped relieve some of the stress of trying to avoid them. As she explained:

I guess so, yeah, and realizing we can't control everything, there's some things that you have to do, and, that the baby's going to turn out okay. [laughs] …I think it's a little liberating knowing that, er, a little freeing, you know, using your mind to realize you can't control everything.

More common and well-known risks in pregnancy such as smoking, drinking, and cleaning products were often managed through simple avoidance behaviours. As PW-12 explained:

Risks that I avoid, your regular stuff like drugs and tobacco exposure, um, exposure to litter, cat litter, and just chemicals that we're breathing in, you know, Fantastic or that type of thing I've avoided or tried to.

PW-14 commented on her husband's smoking and other potential risky habits:

He knows what he does is risky and he's very cautious cause he's a smoker and stuff like that. But he's cautious to not smoke around me and to not expose me to the things the things that he knows are risky at work, but to find out if there's other things that we do that are harmful, no, he doesn't… If I tell him then he'll react appropriately, so.

These avoidance behaviours, however, were not without their consequences for some women. For example, PW-12 described experiencing feelings of isolation as a consequence of avoiding risky situations. As she explained:

> *So it's kind of, you know, we're trying to do something like smoking, he smokes in the car, or used to smoke in the car all the time, now it's sort of like, we go somewhere, okay, I'm going to go smoke a cigarette. He gets out of the car while I'm sitting in the car [laughs] so it's just sort of, you know, I don't know there's other factors just beyond the physical part that kind of, I don't know, it isolates yourself and when you're trying not to be around people, or do things, you end up isolating yourself a little more. Um, definitely I feel better all going out, even if it's not to a club but you're all at somebody's house, you know, our friends smoke in their home... don't go to their house right now, cause their house is a big smoky mess, so it's not, I won't go there.*

PW-23 also experienced a frustration with people who smoked around her in public:

> *I don't know, I don't understand, people … they don't understand that you don't wanna sit next to someone who's smoking a cigar or something, like, like if you're out or whatever, it's just, I don't know. You take more precautions, you do, because if I wasn't pregnant, like I was out, like having dinner with someone or something, I wouldn't care if we had to wait for someone to finish their smoke or whatever, but if I was pregnant I'd, I don't appreciate people smoking around me.*

Other women experienced stress from having to take the responsibility of making these decisions regarding risk. For example, PW-20 said:

> *I feel that it's on the pregnant women themselves. It would be nice if this society, and the people around would, um, help out in that, for sure, but, yeah, I feel it's very much on your shoulders*.

PW-14 discussed the emotional toll it can take to be consistently vigilant regarding risk during pregnancy:

> *Ah, I find it can be very overwhelming, especially being our first child, not only the fact that it's in me but also that, you know, you're responsibility for a living being 24/7 in a few months, so yes, it can be very overwhelming. I think more for my husband than myself…*

PW-22 recalled her feelings during a previous pregnancy when she first found out about the health effects of BPA:

> *No, it's upsetting because you think what did I, what have I put into him now, and when, when are the side effects going to show, or I mean jokingly, well we say, well that explains it! [laughter]. But you do, you do worry, like, how unfair is that that I put that into him, or whatever he was exposed to*.

Women used a variety of methods to decide whether or not to act on information regarding risk and pregnancy and to what extent. Each woman often used multiple methods simultaneously to arrive at a decision. These decisions were not without their emotional consequences as various women expressed feelings of isolation, frustration, and distress as a result of their risk-avoiding behaviour. Alternatively, some women experienced relief when they realized that they had little control over household chemical risks such as phthalates.

4.4 Summary of Results

Through an ongoing and iterative analytic approach to interview transcripts of 23 pregnant women and 11 obstetrical care providers (obstetricians, family physicians, and midwives) from Southwestern Ontario, two separate but related models emerged.

The first model depicts women's and obstetrical care provider's perceptions of the relationships during pregnancy and how these relationships facilitate women's understanding of risk. Salient relationships included the women-family relationship, the women-obstetrical care provider relationship, and the obstetrical care provider-governing body relationship. This model highlighted how these inter-dependent relationships influence each other and point to where tensions in the relationships arise.

The second model explores women's appraisal of information and how the work towards making decisions and controlling exposures to risk (if at all). The model describes the various interrelated methods used throughout the complex process. Taken cumulatively, these two models provide complimentary insight into how women understand household chemical risk and negotiate risks during pregnancy. The next and final chapter will discuss these findings, their relation to relevant literature, and the implications these results have for future practice, policy, and research.

5 DISCUSSION AND IMPLICATIONS

5.1 Introduction

The two models developed in this study offer unique but related perspectives on women's experiences regarding household chemical risk information during pregnancy. A notable difference between Model 1 and Model 2 is the level of specificity found in the second model relative to the first. Model 1 offers a broad view of the salient relationships in pregnancy and how they influence each other while Model 2 depicts the perceived processes women engage in to access, understand, combine, and act on various sources of risk-related information during pregnancy. Model 1 depicts pregnant women as players in a complex of web of networks acting on and being acted upon by other players while, Model 2 depicts pregnant women as self-determining agents, successfully assimilating a wide range of information, opinions, and personal experience to make a rational decision regarding risk in pregnancy. The differences make these two models seemingly irreconcilable. How, then, can one support the previous claim that the two models are related?

To understand the relationship between the models, they must be situated within the context of literature regarding pregnant women's experiences with motherhood and risk. In doing so, it becomes clear that each model is a depiction of predominant discourse that typically surrounds women during pregnancy. Model 1 depicts the increasing prevalence of expert risk discourses and the medicalization of pregnancy. Model 2 offers a depiction of women effectively managing information, and making decisions for the benefit of her children (Murphy, 2000). Taken cumulatively, the two

models can be seen as managing the tensions of the opposing discourses and making sense of their experiences during pregnancy.

The following aims to situate the results within the relevant body of literature regarding motherhood and risk. The tensions between the two models will be understood as opposing expressions of modern attitudes towards risk. The concept of relational autonomy will be used to relieve the tensions found between the two models and foster women's autonomy. The chapter concludes by elaborating on the future implications of this work for practice, policy, and research.

5.2 Risk Discourses and Model One

At the beginning of the 20th century, risk calculations and predictions regarding health outcomes became a central tenant of scientific understanding and discovery (Conrad, 1992; Tardy, 2000). During this time, pregnancy, previously considered as something normal and natural came to be seen as a time of illness which threatens both maternal and fetal health (Parry, 2008). This new understanding of illness and disease shifted healing from the private domain to the public domain of medicine and experts (Tardy, 2000). This placed an expectation on pregnant women to turn to expert sources of information regarding risk in pregnancy in favor of personal experiences (Miller, 2005). This has had the effect of pushing the women to the periphery of the pregnancy experience (Lupton, 1999; Mackenzie Bryers & van Teijlingen, 2010; Murphy, 2000).

Model 1 can be understood as the influence of expert risk discourses on participants' perceptions of phthalates and other household chemical risks in pregnancy. The first model maps out the relationships the women and clinicians interviewed identified as important in learning about and taking action against risks in pregnancy.

What was immediately striking was the emphasis both women and clinicians put on the value of their relationship together. Women looked to healthcare providers to provide accurate and relevant information regarding risk and pregnancy. Obstetrical care providers also felt that it was their role to provide information regarding risks in pregnancy. Obstetrical care providers were relied on to have an expert knowledge over pertinent information in pregnancy and provide women with sound scientific evidence regarding risk information. By having the pregnant woman-healthcare provider relationship as the central relationship in the model, Model 1 resonates with current thought regarding expert discourses of risk and the need for expert advice during pregnancy.

An interesting finding from this study was that neither the obstetrical care providers (with the exception of Midwife 1) nor the women had previous knowledge of phthalates. Upon learning about phthalates in the interview, women immediately expressed a concern regarding phthalates, desired to learn more, and expected their obstetrical care providers to provide information. Conversely, clinicians were not particularly concerned about the risks of phthalates or other household chemicals during pregnancy. This added another layer of complexity and tension to the pregnant woman-healthcare professional relationship. Specifically, it suggests a tension between women's expectation to receive information on a wide range of risks from her healthcare provider and a lack of concern from clinicians as a result of a lack of evidence.

These tensions likely emerge from the differing orientations towards risk between women and healthcare professionals. Linell and colleagues (2002) summarize this tension:

> Although health care professionals can talk about risk in scientific terms amongst themselves, they must, in their clinical practices, 'recontextualize' (Linell, 1998) something that is meaningful only at the statistical level of probability within a population in such a way that it applies to the individual patient (pp. 197).

For women, risk perceptions are danger-oriented and experienced based (Hunt, Castaneda, & de Voogds, 2006; Lupton, 1999; Miller & Solomon, 2003). This was evident throughout at the study as women expressed concern regarding a wide variety of risks including air quality, exercise, and work-related risks.

For healthcare professionals, risk carries more scientific connotations consistent with expert risk discourses (Linell, Adelsward, Sachs, Bredmar, & Lindstedt, 2002; Miller & Solomon, 2003). That is, clinicians look for statistically expressed probabilities of a particular occurrence within a population (Mackenzie Bryers & van Teijlingen, 2010). This was demonstrated in Family Practitioner 2's (FP-2) interview when she explained that she would require an evidence-based risk assessment of phthalates before she would counsel women about phthalates in her practice. FP-3s need for statistical probabilities regarding the risk of phthalates can be seen to be in conflict with lay understandings of risk and an example of the tension between clinicians and pregnant women in Model 1.

Although obstetrical care providers relied on statistical and scientific calculations to determine the legitimacy of a particular risk, this study found that clinicians were not initially judging the significance of risks themselves. Instead, clinicians depended on the government reports and their governing professional bodies (such as Health Canada the Society of Obstetricians and Gynaecologists of Canada [SOGC]) for rigorous and

systematic reviews of the appropriate scientific literature to report any significant risks. Lack of scientific evidence regarding risks by these bodies was implicit confirmation to the clinicians that household chemical risks, such as phthalates, were not significant and provided sufficient reason to not provide counselling.

These findings resonate with sociological research studying uncertainty in medical practices (Atkinson, 1984; Katz, 1984; Light, 1979; Timmermans & Angell, 2001). Uncertainty refers to both the unknowns in medical knowledge as well as the impossibility of mastering all of the ever-expanding medical knowledge (Timmermans & Angell, 2001). Studies have found that in the face of uncertainty, medical practitioners tend to lean heavily on the dogmatic medical paradigms while downplaying and disregarding uncertainties (Katz, 1984). Accordingly, health professionals turning to their governing bodies to resolve the uncertainty regarding the risk of phthalates can be seen as clinicians dogmatically relying on medically based risk discourses. That is to say those obstetrical care providers manage uncertainty by neglecting it and shifting the focus to risks that can be known and controlled (Light, 1979).

By taking a wide scope to examine women's social networks during pregnancy, Model 1 highlights the influence of expert risk discourses in pregnancy. Participants' perception of the pregnant women-healthcare professional relationship as the central relationship in the model is likely the best demonstration of this finding. The lack of trust women and clinicians placed in relationships with the media and manufacturers to provide reliable information also gives credence to the dominance of medical discourses. The model gives insight into the pervasiveness of the expert discourses and decreasing control women play in their own pregnancy (Horton-Salway & Locke, 2010; MacKenzie

Bryers & von Teijlingen, 2010). Although women expected clinicians to provide as much information regarding risks as possible, clinicians often took a paternalistic stance on providing information regarding household chemical risk. This resulted from a lack of evidence provided from the Canadian government and other regulating bodies. Again, this resonates with expert discourses of risk that assumes no risk exists until scientifically determined (Timmermans & Angell, 2001). Taken cumulatively, Model 1 demonstrates the interdependency of pregnancy and how medical discourses influence perceptions of household chemical risk and phthalates.

5.3 Social Constructions of *Good* Mothering and Model Two

Despite the medicalization and dominance of risk discourses in pregnancy, scholars have noted that women are still held socially responsible for the health of themselves and their fetus (Miller, 2005; Murphy, 2000). In order to align themselves with social constructions of a *good* mother, women must present themselves as self-regulated and selfless individuals dedicated to the well-being of their developing fetus and family (Lupton, 1999). This requires pregnant women to negotiate a wide range of information including personal experience, society, family, and expert advice (Miller, 2007; Tardy, 2000). Model 2 can be seen as women constructing themselves as responsible and reasonable consumers of health information in a way that aligns them with social conceptions of the *good* mother. Some authors refer to these social constructions as neo-liberal discourses of motherhood (Murphy, 2000; Rose, 1999) and intensive mothering (Miller, 2005; Lee, 2008). However, due to a lack of specificity and consistent use of the terms, they will not be used further in this discussion.

The individual components of Model 2 (New Information, Value Modifiers, and Decision Making) offers support to the claim that the women studied describe themselves as systematically negotiating risk information and making well-reasoned and responsible decisions. The first section of the model, New Information, shows the information women receive belonging to a continuum of perceived strength from weak to strong. Perceived weak sources such as television, the internet and family resonate with the expert risk discourses which view lay interactions with health information as a dangerous endeavor (Miller, 2005; Nettleton, Burrows, & O'Malley). Not surprisingly, healthcare professionals, manufacturers and the government, which are considered authoritative bodies in Western culture (Miller, 2005), are perceived as strong sources of information by women. The construction of this information continuum, then, demonstrates women's perceptions of the dangers of the information age, and the need for prudence when evaluating weaker sources (Nettleton et al., 2005).

Given the distrust of a variety of information sources, the second section of Model 2, Value Modifiers, offers insight into how women appraise various sources of information to determine the significance. The value modifiers women described in the interviews can be seen as rhetorical devices to align themselves with social ideals of the rational and loving mother. Using techniques such as Cross Referencing, Consensus Building, and seeking a Unified Message are ways women demonstrate their caution with information they receive from weak sources. This need for caution is consistent with professional-medical critiques of the information age which sees the surplus of information in Western society as particularly dangerous for lay people (Nettleton et al., 2005).

The value modifier of Personal Experience is a notable exception to women aligning themselves with professional critiques of information. Previous pregnancies were particularly influential in shaping women's current perceptions of information and risk. For example, PW-22's two previous and relatively uneventful pregnancies made her less worried about risks during pregnancy. However, PW-23's miscarriage during her second pregnancy has made her more risk-aversive. These examples demonstrate women's trust in their experiences and personal understandings of pregnancy to evaluate risk and not purely rely on social constructions of the *good* mother.

Previous research has documented how women's experience of motherhood can lead women to reflect on social discourses regarding mothering and challenge them (Kelha, 2009; Lee, 2008; Lupton, 1999; Miller, 2007). For example, women often learn that the social and medical pressure they experience to engage in breast feeding is an unrealistic expectation (Lee, 2008; Miller, 2007). Moreover, women often come to see formula feeding as a reasonable alternative (Murphy, 2000). However, this research notes that women do not fully reject the risk discourses surrounding motherhood but simply learn to re-interpret their experiences within them (Miller, 2007; Tardy, 2000). The value modifier of personal experience creates space for women's own understanding of risks in pregnancy to interact with the discourses of risk and motherhood.

The third section of the second model, Decision Making and Controlling Exposure, offers the most explicit evidence of women constructing themselves as good mothers by presenting themselves as reasonable and responsible individuals. The section is a description of women's actions regarding risk information they have appraised and deemed significant. The decision making constructs women discussed such as advanced

planning, responsibility and balancing risk are immediately recognizable as terms consistent with culture of individual risk management (Beck, 1992). The women are presenting themselves as autonomous and rational beings fully capable of making reasoned actions for the benefit of themselves and their fetus. Other constructs in the decision making framework including alternatives, isolation, and expense compliment this picture. Women have taken on the responsibility to care for the health of their fetus at a personal and financial cost to themselves. The elements comprising the Decision Making and Controlling Exposure section of Model 2 can be seen as women constructing themselves as responsible mothers willing to sacrifice themselves for the health of their families.

Finally, the overall form of Model 2 lends support to the notion that the women's perceptions of risk, responsibility and decision making are consistent with social discourses of good mothering. The model presents the process of receiving, appraising, and acting on risk information as a fairly straightforward process. This creates the impression of women engaging in a rational process of weighing various sources of information and making a well-reasoned decision. The women are presenting themselves as self-regulating, self-determining mothers putting their child's needs ahead of their own. Through this, they are aligning themselves with current social perceptions of the good mothers (Miller, 2007; Murphy, 2000).

5.4 Identifying the Relationships between Model One and Two

By contextualizing each model within current literature regarding risk and pregnancy, it becomes clear that both models, although often in tension with each other, reflect two predominant discourses in pregnancy and motherhood. By depicting women

as one player in a complex web of relationships in pregnancy, Model 1 reflects the increasing medicalization of pregnancy and depicts the increasing loss of control women experience. Conversely, Model 2 depicts women as self-disciplined, rational beings placing the well-being of their fetus ahead of themselves and acting as a *good* mother would be expected.

Both of these models, however, emerge from the current climate of risk and uncertainty in modern society (Beck, 1992). As science and technology progresses, pregnancy increasingly becomes conceptualized as a potential risk to maternal and fetal health (Mackenzie Bryers & van Teijlingen, 2010). Assumptions regarding women's natural ability to mother along with social discourses of individualism pressure women to engage in risk-reducing behaviours to ensure healthy pregnancy (Model 2) (Murphy, 2000; Tardy, 2000). Failure to do so places women in moral danger of being labeled as a "bad" mother (Lupton, 1999). Accordingly, the advice of obstetrical care providers, regarded as authoritative models on risk in pregnancy, is increasingly valued and sought by women in order to make the best decisions possible (Kelha, 2009; Tardy, 2000). The trust in the medical profession leads to the increasing medicalization of pregnancy and women's loss of control over their pregnancy (Model 1) (Jordan & Murphy, 2009; Miller, 2005; Parry, 2008). In summary, the two models can be seen as depictions of conflicting social responses arising from the same motherhood discourses interweaving with modern risk discourses.

5.4.1 *Construction of Risk, Motherhood, and Implications for Women's Choice*

Tensions between social expectations for women to be responsible and self-regulating during pregnancy and expert risk discourses that require women to defer to

authority have been identified by scholars (Lupton, 1999; MacKenzie Bryers & van Teijlingen, 2010; Marshall & Woollett, 2000; Miller, 2005; Tardy, 2000). Rebecca Tardy (2000) writes:

> Mothers are caught in a struggle between following family practices, her own instincts, and institutional directives, between a desire to fulfill the role of motherhood and to fulfill her own dreams and ambitions. This confusion has real consequences: if the mother fails, if her child becomes ill, then not only does she hold herself responsible but others hold her responsible as well. (pp.445)

A particular concern arising from the contradicting discourses is the implications of agency and choice in pregnancy (Horton-Salway & Locke, 2010; Jordan & Murphy, 2009; Marshall & Woollett, 2000). Horton-Salway and Locke (2010) wonder whether women are ultimately encouraged to make their own decisions during pregnancy or oppressed by the medicalization of the pregnancy experience?

Scholars who have studied the question provide interesting insight into the problem. They argue that women's agency is embedded within a rhetoric of choice which is itself embedded within modern risk discourses (Horton-Salway & Locke, 2010). In other words, women are coerced into making risk-reducing choices based on paternalistic ideologies of science and medicine (Baker, Choi, Henshawk, & Tree, 2005; Edwards & Elwyn, 2001; Marshall & Woollett, 2000). For example, in a discourse analysis of eight popular pregnancy books, Marshall and Woollett (2000) found that "women's choices are hedged in by institutional constraints and, by setting women's choices against the 'needs' and 'safety' of their babies, they are discouraged from exercising choice" (pp.364). Although women may be treated as autonomous agents, they are pressured into accepting

expert advice out of danger of being labeled as a bad mother (Horton-Salway & Locke, 2010; Murphy, 2000).

Similar findings regarding women's autonomy are found in the context of this current study. Women perceived themselves as autonomous agents searching for as much information as possible regarding risk in pregnancy in order to make an informed choice. However, risk information provided by their obstetrical care provider was often sufficient reason for most women to engage in risk-aversive behavior (Model 2). This immediate acceptance of expert advice can be seen as a product of the coercive nature of expert risk discourses and call into question the true autonomy of the women. Moreover, the various social networks in pregnancy, captured by the wide scope of Model 1, provide additional insight into the social circumstances of women and the implications for their decision making (Lambert, Soskolne, Bergum, Howell, & Dossetor, 2003). Given moral and social imperatives to promote women's choice during pregnancy (Buchanan, 2008; Grill & Hansson, 2005; Jordan & Murphy, 2009; Weed & McKeown, 2003), along with women's desire to learn about the risks of phthalates, what options are available for women to learn more about household chemical risk and improve their decision making? The following section will apply the concept of relational autonomy to address this question.

5.5 Relational Autonomy

The concept of relational autonomy emerged out of a wealth of feminist literature that critiqued liberal conceptions of autonomy for its unrealistic assumptions, particularly it's over emphasis on individualism (Christman, 2004; Nedelsky, 1989). Feminist authors argue that liberal conceptions of autonomy fail to capture the social nature of the self and

the way identity is constructed, in relationship with others (MacKenzie & Stoljar, 2000; Nedelsky, 1993). People's understandings, perceptions, and attitudes are a product of their social and cultural contexts (Kukla, 2005). For example, the language one uses to communicate ideas is socially constructed and culturally dependent (Nedelsky, 1989). Accordingly, the most fundamental way people perceive and describe the world is socially determined. However, this is frequently overlooked by liberal theories of autonomy.

The term relational autonomy was first conceptualized by Jennifer Nedelsky (1989) in her essay *Reconceiving Autonomy: Sources, Thoughts and Possibilities*. Nedelsky maintains the value of autonomy in modern society as fundamental to protecting the rights, opinions and choices of individuals and particularly women. Building off of previous feminist work, Nedelsky re-conceptualizes the concept of autonomy to account for the social embeddedness of individuals. Nedelsky argues that autonomy is not a static quality possessed by individuals but a competency that can be promoted or defeated by a person's social context and relationships. For Nedelsky, the challenge for relational theorists is "to understand what social forms, relationships, and personal practices foster that capacity" (pp. 10).

Relational autonomy became popularized in bioethics literature by feminist philosopher Susan Sherwin (1998). Like Nedelsky, Sherwin recognizes the importance of autonomy for protecting individual choice and as a central piece to the feminist movement in general. However, she rejects the individualistic and often oppressive nature of traditional conceptions of autonomy. Within the context of healthcare, Sherwin points to the patient-healthcare provider relationship as particularly threatening to

women's autonomy. Sherwin's discussion of the dominance of medical discourses in Western society and the implications these discourses have on women's ability for self-determination is a particularly relevant concern to this conversation. Accordingly, Sherwin argues that in order to maximize an individual's autonomy, we must expand current conceptions of autonomy to account for the social and political influences that enable and impede individual action and choice.

Sara Goering (2008) explores relational autonomy on a more personal level. She reflects on her experiences as a new mother and some of the insecurities she felt regarding taking care of her new baby. Goering describes issues of anxiety, inexperience, and tiredness that affect rational decision making and critical reflection after parents give birth to a child. She argues that experiencing autonomy in the traditional sense is highly compromised, but rejects the idea of medical paternalism as an appropriate alternative. Instead, she suggests that clinicians have a duty to help develop competencies in patients that promote autonomous decision making. Specifically, Goering talks about how she experienced trust issues with her physician, partner, and with herself. She concludes by arguing for health professionals to take a more relational approach to their care and work to develop competencies such as trust, self-trust, and self-respect.

5.5.1 *Relational Autonomy, Risk Discourses, and Pregnancy*

When examining the issue of women's autonomy in the context of household chemical risk and pregnancy, the concept of relational autonomy seems particularly fitting. Indeed, it is not surprising that Nedelsky (1989) uses child rearing as a symbol of relational autonomy. This is because relational autonomy exposes the false dichotomy between social discourses that stress individual responsibility on women (i.e., traditional

autonomy) and expert risk discourses (i.e., paternalism) and looks at the social contexts that constructed these discourses and the relationships that promote them (Goering, 2008). When we acknowledge that social constructions of motherhood and expert-risk discourses are a product of social, historical, and political forces, we can begin to challenge and overcome their potentially oppressive implications (Sherwin, 1998).

When reflecting on the results of the study, it is not hard to see that the women and obstetrical care providers were indeed struggling with issues of autonomy and paternalism in relation to household chemical risks and pregnancy. When reviewing the transcripts, it seems as though participants are trying to come to terms with the ubiquitous nature of phthalates, the current state of phthalate science, and the difficulties of ascribing responsibility. In effect, women were acknowledging the insufficiencies of traditional conceptions of autonomy and paternalism. For example, when discussing who should be responsible for educating women about phthalates, PW-16 was unsure. She explained that she would like her physician to discuss the risk of phthalates and other household chemical risks with her but, given the current uncertainty regarding phthalates, PW-16 understood why physicians would choose not to discuss it. PW-16 concluded that, at present, she would have to research phthalates for herself. This example demonstrates the difficulties women were experiencing when trying to understand the social implications of phthalates through the current social lens of autonomy and paternalism. A relational autonomy approach to risk and pregnancy overcomes this dichotomy by acknowledging individuals as social agents. Accordingly, responsibility is ascribed at both the individual and social level.

Lambert and colleagues (2003) have studied the role of relational autonomy in improving our environmental health. The authors argue that "public health and environmental ethics should be grounded in particular human relationships and our ongoing relationship with the environment" (Lambert et al., 2003, p. 134). This imperative for a relational ethics approach to environmental health arises from the insufficiencies and tensions between paternalistic and traditional autonomy models of decision making. Lambert and colleagues (2003) "see fostering autonomy as the middle ground, where neither the person, community, nor healthcare provider are alone, but each co-exist in relationship in making decisions through genuine dialogue" (pp, 134). Finally, Lambert offers five steps to fostering relational autonomy: 1) open mindedness 2) developing one's own perspective 3) seeking opportunities for new insight 4) seeking new opinions 5) care for community and environment. He posits that these five steps promote the right to know about environmental risks and offers a mechanism for all members of society to foster their autonomy.

Our research suggests that obstetrical care providers view women's rights to know about phthalates through a more paternalistic paradigm while women's views are more consistent with traditional discourses of autonomy. Using a relational autonomy lens could potentially resolve these tensions. Relational autonomy forces us to go beyond the concept of informed decision making and look at the nature of the pregnant woman-health professional relationship including the mechanisms of trust and self-trust in this relationship (Baylis, Kenny, Sherwin, 2008; McLeod & Sherwin, 2000). Does the woman trust the healthcare provider to provide all known information regarding risk? Does the healthcare provider trust him or herself to provide competent care?

Although Model 1 was initially seen as a depiction of the medicalization of pregnancy, it can now also be viewed as a depiction of the relational dimension of women's experiences of pregnancy. The various relationships shown in the model offers insight into the context of women's decision making such as the influence of the family and community on women's decisions. Moreover, through a depiction of obstetrical care providers' relationships, the model highlights the limits to what knowledge is currently offered to women as a result of policies and decisions made by the SOGC and Health Canada. In this light, Model 1 can be seen as opportunity to address the dominance of medical discourses in pregnancy and foster other important relationships in women's lives. Change can occur by engaging in open and meaningful dialogue between health professionals and communities (Goering, 2008; Lambert et al, 2003). Moreover, steps need to be taken to develop competencies in communities and individuals to give them confidence in their ability to affect change and make meaningful choices in their lives (Dodds, 2000). Taken cumulatively, a relational approach fosters a collective, open and proactive approach to household chemical risk and pregnancy.

5.6 Limitations of the Research

The findings in this study were co-constructed between the participants and the research team. The results represent themes between participants but do not necessarily capture all individual perceptions. The women and clinicians interviewed in this study reflect the lived experience of risk and pregnancy in South Western Ontario. Due to the methodological limitations of constructivist grounded theory, this research, including Models 1 and 2 are not generalizable beyond the pregnant women and obstetrical care providers. Readers are encouraged to engage with the results and reflect on the

similarities and differences of their experiences with those shared in this study. Further, our methodology could not include all social group identities, pregnancy, or clinical experiences. Further research is needed to explore women's experiences with household chemical risks in other contexts, cultures, and geographic locations.

5.7 Study Implications

5.7.1 *Implications for Practice*

The most pressing implication from this study is the need for more information provision to and from healthcare professionals regarding risks of phthalates and other household chemicals. The desire to learn more about phthalates and to understand how they affect pregnancy was made explicit by the pregnant women. Similarly, objections to household chemical counseling offered by clinicians due to lack of time and paucity of firm evidence and guidelines must also be considered.

The results depicted in Model 2 offer the most insight into how to create education material for pregnant women. New sources of information exist on a perceived continuum from weak to strong. Weak sources can be given increased significance when vouched for by strong sources such as physicians or the government. Moreover, new information was perceived as more significant to women when strong sources sent out a unified message, such as in a Society of Obstetricians and Gynaecologists of Canada Guideline, Committee Statement or information materials. A unified strong-to-weak source dissemination strategy may hold the most promise for increasing phthalate awareness and educating women during their pregnancy. This method may be particularly ideal for health professionals with time constraints on their practice and lack of expertise regarding household chemical risk.

During the interviews, a few of the women stated that they would like a website consistently vouched for by strong sources that they could visit to learn more about phthalates and other risks. A particularly vivid description of this website was offered by PW-15. She suggested that a wide range of potential risks should be presented pictorially on a continuum of certainty. For example, phthalates would be found on the less certain end of the spectrum while smoking and drinking would be located on the certain end of the continuum. As new knowledge about a particular risk becomes available, the risk is moved up or down the continuum accordingly. Upon clicking on an identified risk, more information would be provided including avoidance strategies, alternative products, and links to original research. The need for a website endorsed by strong sources expressed by PW-15 and the other participating women offer a practical and elegant solution to providing household chemical risk counselling to pregnant women.

Although a website with risk information would be ideal way to offer women a quick and convenient source for risk information, it does not fully address the relational components of women's autonomy. This is because it focuses too much on the one-way dissemination of information and not enough on how to properly asses the risk in the context of the women's life and how to support women's decision making (Sherwin, 1998). Accordingly, having a web site would be a necessary but insufficient component to providing household chemical risk education. There also needs to be space for relational autonomy's key tool, meaningful dialogue, to help develop women's decision making competencies and autonomy.

A possible opportunity to engage in meaningful dialogue with pregnant women regarding household chemicals in pregnancy could be during prenatal classes. This

strategy would take advantage of an identified strong source of information that pregnant women commonly use. Moreover, prenatal classes often bring together various health professionals and pregnant women into one room. However, prenatal classes generally occur after the embryonic and fetal stages in which the concerns regarding the effect of phthalates on organogenesis have been reported to occur (Swan, 2005). Opportunities to provide counseling preconception or during early pre-natal care should be considered.

Another possible concern is the current dominance of the medical discourses in prenatal classes (Horton-Salway & Locke, 2010) and the potential difficulties overcoming these paternalistic attitudes in favour of a more relational approach to education. However, if a relational approach was adopted, prenatal classes would appear as ideal candidates to help cultivate women's capacity for autonomy during pregnancy.

In summary, the results of this study suggest a strong need to provide household chemical risk counselling for pregnant women. A trusted website consistently promoted by strong sources (i.e., health professionals, government, and manufacturers) was offered as an ideal information source by participants. Using prenatal classes as an opportunity for women to engage in meaningful dialogue about household chemical risk was recommended as an opportunity to address women's relational autonomy and develop their competencies. These strategies offer a preliminary plan to address women's expressed desire to learn about household chemical risks meaningfully while managing counselling barriers identified by health professionals.

5.7.2 *Implications for Policy*

A clear finding from this study was that obstetrical care providers looked to the government and their professional regulating bodies to review the scientific literature and

identify important risks that need to be addressed in practice. Currently, regulating bodies such as Health Canada and the Society of Obstetricians and Gynaecologists (SOGC) are yet to conduct a comprehensive review for phthalates and other household chemical risks. Given the increasing attention phthalates and other risks are receiving in the media, it is reasonable to expect that phthalates will be an issue clinicians will increasingly have to confront in their practice. Accordingly, governing bodies, such as the SOGC, should consider conducting a comprehensive literature review of phthalates and providing an easily accessible report for their members.

As a compliment to the literature review, the SOGC and other governing bodies could provide guidelines instructing clinicians on how to provide counselling regarding household chemicals and other uncertainties that may come up in practice. Although pregnant women felt that household chemical risks such as phthalates were important, this study found that obstetrical care providers often down played the importance of providing counselling for these poorly established risks in their practice. Obstetrical care providers need to be equipped with the appropriate skills and knowledge to help counsel pregnant women when questions arise in practice. Developing guidelines that focus on how to handle uncertainties in practice may be a helpful method to address this issue practice. Moreover, consistent with a relational approach to household chemical risks, regulating bodies should consider eliciting pregnant women and other community members' advice in the construction of these policies. The results from this study would also provide a good starting part for understanding women's perceptions of environmental risks, household chemicals, and their information needs.

5.7.3 *Implications for Future Research*

The current study explores a relatively unstudied area regarding pregnant women's perceptions and experiences of household chemical risks. By identifying salient relationships in pregnancy as well as exploring how pregnant women navigate and act on new information, new research directions have emerged.

Firstly, a new study could build upon this current one to develop a more nuanced understanding of women's perceptions and understandings of phthalates. Specifically, a study would benefit from a more longitudinal design to appreciate women and clinicians shifting attitudes towards household chemical risk over time. One of the interesting aspects of this study was having pregnant women and clinicians learn about phthalates for the first time while they also considered the impact of these risks in their life. However, I could not help but wonder how pregnant women's and health professionals' perceptions of phthalates changed after the interview. Did any of the participants look up phthalates for themselves? What behaviour changes, if any, do women or clincicans engage in after the interview? Do clinicians subsequently include household chemical risk counselling in their practice? A new study that followed up with participants two or three times after the initial interview would develop this understanding and contribute an interesting dimension to the understanding of pregnant women's experiences negotiating household chemical risks.

A second research direction focusing on knowledge translation follows directly from Model 2 (Decision Making in Pregnancy). Model 2 offers unique insight into how women appraise information, manage new risk information and subsequently make decisions. This affords a unique opportunity to develop information material on

phthalates that is tailored to pregnant women and study the effectiveness of the material. This study should include both qualitative and quantitative research methods in order to capture individual's unique experiences while maintaining the opportunity to make generalizable claims. Generalizability is particularly important when designing information materials that aim to be accessible to a wide population.

Finally, clinicians, ethicists, and scientists should come together to continue to develop the conceptual relationship between household chemical risks and relational autonomy. The link between these two areas has gone largely unaddressed and would benefit from further exploration. Once a solid understanding of the environmental science and ethical principles involved is developed, this multidisciplinary work will be both stimulating and rewarding. More work in this area would help lead to the development of sensitive policies regarding risks in pregnancy and develop innovative approaches to fostering women's autonomy during pregnancy.

5.8 Conclusion

The ubiquitous nature of phthalates and other household chemicals pose unique challenges to pregnant women. This study sought women's and obstetrical care providers' perceptions of phthalates in the environment and how these perceptions influence women's decision making. Two separate but related models emerged from the analysis. The first model depicts participants' perceptions of salient relationships in pregnancy, while the second models women's perceptions of risk information and their subsequent decision making process. The discussion demonstrated how the first model is an expression of women's perceptions of the increasing medicalization of pregnancy and the second is consistent with social discourses that encourage women to be self-

regulating, self-determining, and selfless mothers. The tension between these two discourses has implications for women's autonomy. Women may feel like they are making independent decisions regarding their pregnancy but are actually being influenced into those choices due to the predominance of medical discourses. The concept of relational autonomy was then explored as a potential resolution to the tensions of the two discourses. Through a relational approach to risk and pregnancy, women and their capacity for self-determination are seen as inseparable from the rest of their social context. Communities must identify and promote relationships that enable women's ability to learn about household chemical risks, reflect on this information meaningfully, and make decisions that best fit their lives. Finally, the implications of the two models on practice, policy, and research were discussed.

Hopefully, this work will contribute to a new sensitivity and appreciation of women's experiences with household chemical risk in pregnancy and point to new and innovative solutions to these issues.

REFERENCES

Altman, R., Morello-Frosch, R., Brody, J., Rudel, R., Brown, P., & Averick, M. (2008). Pollution comes home and gets personal: Women's experience of household chemical exposure. *Journal of Health and Social Behavior, 49*(4), 417-417-35.

American Chemistry Council. (2012). *Phthalates.* Retrieved, 2012, from http://phthalates.americanchemistry.com/

American College of Obstetricians and Gynecologists. (2008). *Code of professional ethics*. Washington, DC: American College of Obstetricians and Gynecologists.

Andrady, A. L., & Neal, M. A. (2009). Applications and societal benefits of plastics. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*(1526), 1977-1984.

Arbuckle, T. E. (2006). Are there sex and gender differences in acute exposure to chemicals in the same setting? *Environmental Research, 101*(2), 195-204.

Arnoldi, J. (2009). *Risk: An introduction*. Cambridge, UK: Polity Press.

ASEAN (The Association of Southeast Asian Nations). (2008). *Annex II of Cosmetic Directive*.

Associated Press. (2011). *Lead, phthalates, choking still a danger in children's toys.* Fox News. http://www.foxnews.com/health/2011/11/23/lead-phthalates-choking-still-danger-in-childrens-toys/.

Atkinson, P. (1984). Training for certainty. *Social Science and Medicine, 19*(9), 949-956.

Atkinson, S. J., & Farias, M. F. (1995). Perceptions of risk during pregnancy amongst urban women in northeast brazil. *Social Science & Medicine, 41*(11), 1577-1586.

Australian Government. (2010). *Competition and Consumer Act 2010 - Consumer Protection Notice no. 11 of 2011 - Permanent Ban on Children's Products Containing More than 1% Diethylhexyl Phthalate (DEHP).*

Baker, S., Choi, P., Henshaw, C., & Tree, J. (2005). 'I felt as though I'd been in jail': Women's experiences of maternity care during labour, delivery and the immediate postpartum. *Feminism & Psychology, 15*(3), 315-342.

Ballinger, C. (2006). Demonstrating rigour and quality? In L. Finlay, & C. Ballinger (Eds.), *Qualitative research for allied health professionals: Challenging choices* (pp. 235-246). England: Whurr Publishers Limited.

Barlow, N., & Foster, P. (2003). Pathogenesis of male reproductive tract lesions from gestation through adulthood following in utero exposure to di(n-butyl) phthalate. *Toxicologic Pathology, 31*(4), 397-410.

Baylis, F., Kenny, N. P., & Sherwin, S. (2008). A relational account of public health ethics. *Public Health Ethics, 1*(3), 196-209.

Beck, U. (1992). *Risk society: Towards a new modernity*. London: Sage Publications.

Blocker, T. J., & Eckberg, D. L. (1997). Gender and environmentalism: Results from the 1993 general social survey. *Social Science Quarterly (University of Texas Press), 78*(4), 841-858.

Blount, B. C., Silva, M. J., Caudill, S. P., Needham, L. L., Pirkle, J. L., Sampson, E. J., . . . Brock, J. W. (2000). Levels of seven urinary phthalate metabolites in a human reference population. *Environmental Health Perspectives, 108*(10), pp. 979-982.

Borch, J., Dalgaard, M., & Ladefoged, O. (2005). Early testicular effects in rats perinatally exposed to DEHP in combination with DEHA-apoptosis assessment and immunohistochemical studies. *Reproductive Toxicology, 19*(4), 517-525.

Bornehag, C., Sundell, J., Weschler, C. J., & Sigsgaard, T. (2004). The association between asthma and allergic symptoms in children and phthalates in house dust: A nested case-control study. *Environmental Health Perspectives, 112*(14), 1393-7.

Brewer, N., Weinstein, N., Cuite, C., & Herrington, J. (2004). *Risk perceptions and their relation to risk behavior.* Springer New York.

Briggs, D. J. (2008). A framework for integrated environmental health impact assessment of systemic risks. *Environmental Health: A Global Access Science Source, 7*, 61.

Canada Gazette. Hazardous Products Act: Order Amending Schedule I to the Hazardous Products Act (Phthalates). Government of Canada 2010144(26). Retrieved from http://gazette.gc.ca/rp-pr/p2/2010/2010-12-22/html/sor-dors297-eng.html

CBC News: Health. (2011). *Phthalates: Soft plastic's hidden hazard* Retrieved from http://www.cbc.ca/news/health/story/2008/06/04/f-phthalates.html

Centers for Disease Control and Prevention. (2009). *Fourth national report on human exposure to environmental chemicals.* United States of America: Department of Health and Human Services.

Chapman, R. R. (2003). Endangering safe motherhood in Mozambique: Prenatal care as pregnancy risk. *Social Science and Medicine, 57*(2), 355-374.

Charmaz, K. (2003). Grounded theory: Objectivist and constructivist methods. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Strategies of qualitative inquiry* (2nd edition ed., pp. 249-291). Thousand Oaks: Thousand Oaks.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Thousand Oaks: Sage.

Ching, N. P. H., Jham, G. N., Subbarayan, C., Bowen, D. V., Smit Jr., A. L. C., Grossi, C. E., . . . Nealon Jr., T. F. (1981). Gas chromatographic—mass spectrometric detection of circulating plasticizers in surgical patients. *Journal of Chromatography B: Biomedical Sciences and Applications, 222*(2), 171-177.

Christman, J. (2004). Relational autonomy, liberal individualism, and the social constitution of selves. *Philosophical Studies, 117*(1-2), 143-164.

Chung, I. J. (2011). Social amplification of risk in the internet environment. *Risk Analysis, 31*(12), 1883-1896.

Cobellis, L., Latini, G., DeFelice, C., Razzi, S., Paris, I., Ruggieri, F., . . . Petraglia, F. (2003). High plasma concentrations of di-(2-ethylhexyl)-phthalate in women with endometriosis. *Human Reproduction, 18*(7), 1512-1515.

Colborn, T., Dumanoski, D. & Myers, J. P. (2006). *Our stolen future.* Retrieved from http://www.ourstolenfuture.org/newscience/oncompounds/phthalates/phthalates.htm

Colborn, T., Myers, J. P., & Dumanoski, D. *Our stolen future: Are we threatening our fertility, intelligence, and survival?--a scientific detective story*. New York, NY: Plume.

Colon, I., Caro, D., Bourdony, C. J., & Rosario, O. (2000). Identification of phthalate esters in the serum of young puerto rican girls with premature breast development. *Environmental Health Perspectives, 108*(9), 895.

Conrad, P. (1992). Medicalization and social control. *Annual Review of Sociology, 18*(1), 209-232.

Cook, R. J., & Dickens, B. M. (2002). Human rights to safe motherhood. *International Journal of Gynecology and Obstetrics, 76*(2), 225-231.

Culty, M., Thuillier, R., Li, W., Wang, Y., Martinez-Arguelles, D. B., Benjamin, C. G., . . . Papadopoulos, V. (2008). In utero exposure to di-(2-ethylhexyl) phthalate exerts both short-term and long-lasting suppressive effects on testosterone production in the rat. *Biology of Reproduction, 78*(6), 1018-1028.

Curtis, S., Gesler, W., Smith, G., & Washburn, S. (2000). Approaches to sampling and case selection in qualitative research: Examples in the geography of health. *Social Science & Medicine, 50*(7-8), 1001-1014.

Darbyshire, P., Collins, C., McDonald, H. M., & Hiller, J. E. (2003). Taking antenatal group B streptococcus seriously: Women's experiences of screening and perceptions of risk. *Birth, 30*(2), 116-123.

David R Buchanan. (2008). Autonomy, paternalism, and justice: Ethical priorities in public health. *American Journal of Public Health, 98*(1), 15-21.

Diamanti-Kandarakis, E., Bourguignon, J., Giudice, L. C., Hauser, R., Prins, G. S., Soto, A. M., . . . Gore, A. C. (2009). Endocrine-disrupting chemicals: An endocrine society scientific statement. *Endocrine Reviews, 30*(4), 293-342.

Dirven, H. A. A. M., Broek, P. H. H., Arends, A. M. M., Nordkamp, H. H., Lepper, A. J. G. M., Henderson, P. T., & Jongeneelen, F. J. (1993). Metabolites of the plasticizer di (2-ethylhexyl) phthalate in urine samples of workers in polyvinylchloride processing industries. *International Archives of Occupational and Environmental Health, 64*(8), 549-554.

Dodds, S. (2000). Choice and control in feminist bioethics. In C. Mackenzie, & N. Stoljar (Eds.), *Relational autonom: Feminist perspectives on autonomy, agency, and the social self.* (pp. 213-235). New York: Oxford University Press.

Douglas, M., & Wildavsky, A. B. *Risk and culture: An essay on the selection of technical and environmental dangers*. Berkeley: University of California Press.

Durodié, B. (2003). The true cost of precautionary chemicals regulation. *Risk Analysis, 23*(2), 389-398.

Duty, S. M., Calafat, A. M., Silva, M. J., Ryan, L., & Hauser, R. (March 2005). Phthalate exposure and reproductive hormones in adult men. *Human Reproduction, 20*(3), 604-610.

Duty, S. M., Singh, N. P., Silva, M. J., Barr, D. B., Brock, J. W., Ryan, L., . . . Hauser, R. *The relationship between environmental exposures to phthalates and DNA damage in human sperm using the neutral comet assay* National Institute of Environmental Health Sciences.

Earl Gray, L., Wilson, V. S., Stoker, T., Lambright, C., Furr, J., Noriega, N., . . . Guillette, L. (2006). Adverse effects of environmental antiandrogens and androgens on reproductive development in mammals1. *International Journal of Andrology, 29*(1), 96-104.

Edwards, A., & Elwyn, G. (2001). Understanding risk and lessons for clinical risk communication about treatment preferences. *Quality in Health Care, 10* (suppl 1), i9-i13.

Ekberg, M. (2007). The parameters of the risk society. *Current Sociology, 55*(3), 343-366.

European Commission. (2011). *REACH.* Retrieved from http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm

European Council for Plasticisers and Intermediates (ECPI). (2010). *Plasticisers and flexible PVC information centre.* Retrieved, 2012, from http://www.plasticisers.org/

European Parliament. (2004). *Directive 2004/93/EC amending Council Directive 76/798/EEC for the purpose of adapting its Annexes II and III to technical progress*.

European Parliament. (2005). *Directive 2005/84/EC of the European Parliament and of the Council of 14 December 2005 amending for the 22nd time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (phthalates in toys and childcare articles).*

European Parliament. (1999). *Directive 1999/81 5/EC of the European Parliament and of the Council of 7 December 1999 adopting measures prohibiting the placing on the market of toys and childcare articles intended to be placed in the mouth by children under three years of age made of soft PVC containing or more of the substances di-iso-nonyl phthalates (DINP), di(2-ethylhexyl) phthalates (DEHP), dibutyl phthalate (DBP), di-iso-decyl phthalate (DIDP), di-n-octyl phthalate (DNOP), and butylbenzyl phthalate (BBP).*

Finlay, L. (2006). 'Going exploring': The nature of qualitative research. In L. Finlay, & C. Ballinger (Eds.), *Qualitative research for allied health professionals: Challenging choices* (pp. 3-8). England: Whurr Publishers Limited.

Finlay, L. (2002). "Outing" the researcher: The provenance, process, and practice of reflexivity. *Qualitative Health Research, 12*(4), 531-545.

Fisher, J. S., Macpherson, S., Marchetti, N., & Sharpe, R. M. (2003). Human 'testicular dysgenesis syndrome': A possible model using in-utero exposure of the rat to dibutyl phthalate. *Human Reproduction, 18*(7), 1383-1394.

Foster, P. M. D. (2006). Disruption of reproductive development in male rat offspring following in utero exposure to phthalate esters. *International Journal of Andrology, 29*(1), 140-147.

Foucault, M. (1991). Governmentality. In M. Foucault, G. Burchell, C. Gordon & P. Miller (Eds.), *The foucault effect: Studies in governmentality: With two lectures by and an interview with michel foucault*. London; Toronto: Harvester Wheatsheaf.

Ge, R. S., Chen, G. R., Tanrikut, C., & Hardy, M. P. (2007). Phthalate ester toxicity in leydig cells: Developmental timing and dosage considerations. *Reproductive Toxicology, 23*(3), 366-373.

Gerbner, G., & Gross, L. (1976). Living with television: The violence profile. *Journal of Communication, 26*, 173-199.

Glaser, B. (2002). Constructivist grounded theory? *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, 3*(3)

Goering, S. (2009). Postnatal reproductive autonomy: Promoting relational autonomy and self-trust in new parents. *Bioethics, 23*(1), 9-19.

Gottvall, K., & Waldenstrom, U. (2002). Does traumatic birth experience have an impact on future reproduction? *British Journal of Obstetrics and Gynaecology, 109*, 254-260.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (1st edition ed., pp. 105-117). Thousand Oaks, CA: Sage.

Gunther Eysenbach, & Christian Köhler. (2002). How do consumers search for and appraise health information on the world wide web? qualitative study using focus groups, usability tests, and in-depth interviews. *BMJ, 324*(7337), 573-577.

Halden, R. U. (2010). Plastics and health risks. *Annual Review of Public Health, 31*(1), 179-194.

Han, D. H. (2000). Fit factors for quarter masks and facial size categories. *Annals of Occupational Hygiene, 44*(3), 227-234.

Hauser, R., Meeker, J. D., Singh, N. P., Silva, M. J., Ryan, L., Duty, S., & Calafat, A. M. (2007). DNA damage in human sperm is related to urinary levels of phthalate monoester and oxidative metabolites. *Human Reproduction, 22*(3), 688-695.

Headley, A. J., M.D., & Harrigan, J. (2009). Using the pregnancy perception of risk questionnaire to assess health care literacy gaps in maternal perception of prenatal risk. *Journal of the National Medical Association, 101*(10), 1041-5.

Health Canada. (2011). *Phthalate fact sheet.* Retrieved from http://www.hc-sc.gc.ca/ahc-asc/media/nr-cp/_2011/2011_07fs-eng.php

HernÃ¡ndez-DÃaz, S., Mitchell, A. A., Kelley, K. E., Calafat, A. M., & Hauser, R. (2008). Medications as a potential source of exposure to phthalates in the U.S. population. *Environ Health Perspect, 117*(2)

Högberg, J., Hanberg, A., Berglund, M., Skerfving, S., Remberger, M., Calafat, A. M., . . . Håkansson, H. (2008). Phthalate diesters and their metabolites in human breast milk, blood or serum, and urine as biomarkers of exposure in vulnerable populations. *Environmental Health Perspectives, 116*(3), pp. 334-339.

Horton-Salway, M., & Locke, A. (2010). 'But you might be damaging your baby': Constructing choice and risk in labour and childbirth. *Feminism & Psychology, 20*(4), 435-453.

Hotchkiss, A. K., Parks-Saldutti, L. G., Ostby, J. S., Lambright, C., Furr, J., Vandenbergh, J. G., & Gray, L. E. (2004). A mixture of the "Antiandrogens" linuron and butyl benzyl phthalate alters sexual differentiation of the male rat in a cumulative fashion. *Biology of Reproduction, 71*(6), 1852-1861.

Howdeshell, K. L., Furr, J., Lambright, C. R., Rider, C. V., Wilson, V. S., & Gray, L. E. (2007). Cumulative effects of dibutyl phthalate and diethylhexyl phthalate on male rat reproductive tract development: Altered fetal steroid hormones and genes. *Toxicological Sciences, 99*(1), 190-202.

Howdeshell, K. L., Wilson, V. S., Furr, J., Lambright, C. R., Rider, C. V., Blystone, C. R., . . . Gray, L. E. (2008). A mixture of five phthalate esters inhibits fetal testicular testosterone production in the sprague-dawley rat in a cumulative, dose-additive manner. *Toxicological Sciences, 105*(1), 153-165.

Hunt, L. M., Castaneda, H., & de Voogd, K.,B. (2006). Do notions of risk inform patient choice? lessons from a study of prenatal genetic counseling. *Medical Anthropology, 25*(3), 193-219.

Hunter, L. M., Hatch, A., & Johnson, A. (2004). Cross-national gender variation in environmental behaviors. *Social Science Quarterly, 85*(3), 677-694.

Hutchison, G. R., Scott, H. M., Walker, M., McKinnell, C., Ferrara, D., Mahood, I. K., & Sharpe, R. M. (2008). Sertoli cell development and function in an animal model of testicular dysgenesis syndrome. *Biology of Reproduction, 78*(2), 352-360.

International Federation of Gynecologists and Obstetrics (FIGO). (2004). *FIGO Professional and ethical responsibilities concerning sexual and reproductive rights.* (International Joint Policy Statement No. 151). Journal of Obstetrics and Gynaecologists Canada: The Society of Obstetricians and Gynaecologists of Canada.

Jonsson, B. A., Richthoff, J., Ryland, L., Giwercman, A., & Hagmar, L. (2005). Urinary phthalate metabolites and biomarkers of reproductive function in young men. *Epidemiology, 16*(4), 487-493.

Jordan, R. G., & Murphy, P. A. (2009). Risk assessment and risk distortion: Finding the balance. *Journal of Midwifery and Women's Health, 54*(3), 191-200.

K Grill, & S O Hansson. (2005). Epistemic paternalism in public health. *Journal of Medical Ethics, 31*(11), 648-653.

Kamrin, M. A. (2009). Phthalate risks, phthalate regulation, and public health: A review. *Journal of Toxicology & Environmental Health: Part B, 12*(2), 157-174.

Karpin, I. (2010). Taking care of the 'health' of preconceived human embryos or constructing legal harms. In J. Nisker, F. Baylis, I. Karpin, C. McLeod & R. Mykitiuk (Eds.), *The 'healthy' embryo: Social, biomedical, legal and philosophical perspectives* (pp. 136-150). United Kingdom: Cambridge University Press.

Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., . . . Ratick, S. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis, 8*(2), 177-187.

Katz, J. (1984). *The silent world of doctor and patient*. New York: Free Press.

Kelhä, M. (2009). Too old to become a mother? Risk constructions in 35+ women's experiences of pregnancy, child-birth, and postnatal care. *NORA—Nordic Journal of Feminist and Gender Research, 17*(2), 89-103.

Koch, H. M., & Calafat, A. M. (2009). Human body burdens of chemicals used in plastic manufacture. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*(1526), 2063-2078.

Kolarik, B., Naydenov, K., Larsson, M., Bornehag, C., & Sundell, J. (2008). The association between phthalates in dust and allergic diseases among bulgarian children. *Environmental Health Perspectives, 116*(1), 98-103.

Kringeland, T., & Möller, A. (2006). Risk and security in childbirth. *Journal of Psychosomatic Obstetrics & Gynecology, 27*(4), 185-191.

Kukla, R. (2005). Conscientious autonomy: Displacing decisions in health care. *Hastings Center Report, 35*(2), 34-44.

Laguë, É., & Tremblay, J. J. (2008). Antagonistic effects of testosterone and the endocrine disruptor mono-(2-ethylhexyl) phthalate on INSL3 transcription in leydig cells. *Endocrinology, 149*(9), 4688-4694.

Lambert, T. W., Soskolne, C. L., Bergum, V., Howell, J., & Dossetor, J. B. (2003). Ethical perspectives for public and environmental health: Fostering autonomy and the right to know. *Environmental Health Perspectives, 111*(2), pp. 133-137.

Latini, G., Scoditti, E., Verrotti, A., De Felice, C., & Massaro, M. (2008). Peroxisome proliferator-activated receptors as mediators of phthalate-induced effects in the male and female reproductive tract: Epidemiological and experimental evidence. *PPAR Research*, 1-13.

Latini, G., De Felice, C., Presta, G., Del Vecchio, A., Paris, I., Ruggieri, F., & Mazzeo, P. (2003). In utero exposure to di-(2-ethylhexyl) phthalate and duration of human pregnancy. *Environmental Health Perspectives, 111*(14), 1783-1785.

Lee, E. J. (2008). Living with risk in the age of 'intensive motherhood': Maternal identity and infant feeding. *Health, Risk & Society, 10*(5), 467-477.

Light, D.,Jr. (1979). Uncertainty and control in professional training. *Journal of Health and Social Behavior, 20*(4, Health Professions: Socialization, Organization, Utilization), pp. 310-322.

Lincoln, Y. S., & Guba, E. G. (2000). Paradigmatic controversies, contradictions, and emerging confluences. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The handbook of qualitative research* (2nd ed., pp. 163-188). Beverly Hills, CA: Sage.

Linell, P., Adelsw ├ñrd, V., Sachs, L., Bredmar, M., & Lindstedt, U. (2002). Expert talk in medical contexts: Explicit and implicit orientation to risks. *Research on Language & Social Interaction, 35*(2), 195-218.

Lupton, D. (1999). Risk and the ontology of pregnant embodiment. In D. Lupton (Ed.), *Risk and sociocultural theory: New directions and perspectives* (pp. 86-107). New York: Cambridge University Press.

MacGillivray, B. H., Alcock, R. E., & Busby, J. (2011). Is risk-based regulation feasible? the case of polybrominated diphenyl ethers (PBDEs). *Risk Analysis: An International Journal, 31*(2), 266-281.

MacKendrick, N. A. (2010). Media framing of body burdens: Precautionary consumption and the individualization of risk. *Sociological Inquiry, 80*(1), 126-149.

MacKenzie Bryers, H., & van Teijlingen, E. (2010). Risk, theory, social and medical models: A critical analysis of the concept of risk in maternity care. *Midwifery, 26*(5), 488-496.

Mackenzie, C., & Stoljar, N. (2000). *Relational autonomy: Feminist perspectives on automony, agency, and the social self*. New York: Oxford University Press.

Mahood, I. K., McKinnell, C., Walker, M., Hallmark, N., Scott, H., Fisher, J. S. . . . Sharpe, R. M. (2006). Cellular origins of testicular dysgenesis in rats exposed in utero to di(n-butyl) phthalate. *International Journal of Andrology, 29*(1), 148-154.

Maienschein, J., & Robert, J. S. (2010). What is an embryo and how do we know? In J. Nisker, F. Baylis, I. Karpin, C. McLeod & R. Mykitiuk (Eds.), *The 'healthy' embryo: Social, biomedical, legal and philosophical perspectives* (pp. 1-15). United Kingdom: Cambrdige University Press.

Main, K. M., Mortensen, G. K., Kaleva, M. M., & Boisen, K. A. (2006). Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age. *Environmental Health Perspectives, 114*(2), 270-6.

Marshall, H., & Woollett, A. (2000). Fit to reproduce? the regulative role of pregnancy texts. *Feminism & Psychology, 10*(3), 351-366.

Martin, D. S. (2010). *Martin DS. 5 toxics that are everywhere: Protect yourself.* Cable News Network (CNN).

Mason, D. (2002). Qualitative interviewing: Asking, listening and interpreting. In T. May (Ed.), *Qualitative research in action* (pp. 225-241). Thousand Oaks: Thousand Oaks.

McKee, R. H. (2004). Phthalate exposure and early thelarche. *Environ Health Perspect, 112*(10)

McKeown, R. E., & Weed, D. L. (2003). Science and social responsibility in public health. *Environmental Health Perspectives, 111*, 1804+.

McLeod, C., & Sherwin, S. (2000). Relational autonomy, self-trust, and health care for patients who are oppressed. In C. Mackenzie, & N. Stoljar (Eds.), *Relational autonomy: Feminist perspectives on autonomy, agency, and the social self* (pp. 259-279). New York: Oxford University Press.

Meeker, J. D., Sathyanarayana, S., & Swan, S. H. (2009). Phthalates and other additives in plastics: Human exposure and associated health outcomes. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*(1526), 2097-2113.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks: Sage Publications.

Milkov, L. E., Aldyeva, M. V., Popova, T. B., Lopukhova, K. A., Makarenko, Y. L., & Shakhova, T. K. (1973). Health status of workers of exposed to phthalate plasticizers in the manfacture of artificial leather and films based on PVC resins. *Environmental Health Perspectives, 3*, 175-178.

Miller, M., & Solomon, G. (2003). Environmental risk communication for the clinician. *Pediatrics, 112*(1), 211-217.

Miller, T. (2005). *Making sense of motherhood: A narrative approach*. Cambridge; New York: Cambridge University Press.

Miller, T. (2007). “Is this what motherhood is all about?”. *Gender & Society, 21*(3), 337-358.

Mills, J., Bonner, A., & Francis, K. (2006). The development of constructivist grounded theory. *International Journal of Qualitative Methods, 5*(1), 1-10.

Morrow, S. L. (2005). Quality and trustworthiness in qualitative research in counseling psychology. *Journal of Counseling Psychology, 52*(2), 250-260.

Mykitiuk, R., & Nisker, J. (2010). Social determinants of 'health' of embryos. In J. Nisker, F. Baylis, I. Karpin, C. McLeod & R. Mykitiuk (Eds.), *The 'healthy' embryo: Social, biomedical, legal and philosophical perspectives* (pp. 116-135). United Kingdom: Cambridge University Press.

Mylchreest, E., Sar, M., Wallace, D. G., & Foster, P. M. D. (2002). Fetal testosterone insufficiency and abnormal proliferation of leydig cells and gonocytes in rats exposed to di(n-butyl) phthalate. *Reproductive Toxicology, 16*(1), 19-28.

Nedelsky, J. (1989). Reconceiving autonomy: Sources, thoughts and possibilities. *Yale Journal of Law and Feminism, 1*, 7-36.

Nedelsky, J. (1993). Reconceiving rights as relationship. *Review of Constitutional Studies, 1*(1), 1-26.

Nettleton, S., Burrows, R., & O'Malley, L. (2005). The mundane realities of the everyday lay use of the internet for health, and their consequences for media convergence. *Sociology of Health & Illness, 27*(7), 972-992.

Nordeng, H., Ystrøm, E., & Einarson, A. (2010). Perception of risk regarding the use of medications and other exposures during pregnancy. *European Journal of Clinical Pharmacology, 66*(2), 207-214.

NTP-CERHR expert panel update on the reproductive and developmental toxicity of di(2-ethylhexyl) phthalate. (2006). *Reproductive Toxicology, 22*(3), 291-399.

OECD. (2008). *Growing unequal?* Organisation for Economic Co-operation and Development.

Pan, G., Hanaoka, T., Yoshimura, M., Zhang, S., Wang, P., Tsukino, H., . . . Takahashi, K. (2006). Decreased serum free testosterone in workers exposed to high levels of di-n-butyl phthalate (DBP) and di-2-ethylhexyl phthalate (DEHP): A cross-sectional study in china. *Environmental Health Perspectives, 114*(11), 1643-1648.

Pant, N., Shukla, M., Kumar Patel, D., Shukla, Y., Mathur, N., Kumar Gupta, Y., & Saxena, D. K. (2008). Correlation of phthalate exposures with semen quality. *Toxicology and Applied Pharmacology, 231*(1), 112-116.

Parry, D. C. (2008). "We wanted a birth experience, not a medical experience": Exploring canadian women's use of midwifery. *Health Care for Women International, 29*(8-9), 784-806.

Peterson, M. (2006). The precautionary principle is incoherent. *Risk Analysis, 26*(3), 595-601.

Pollack, G. M., Buchanan, J. F., Slaughter, R. L., Kohli, R. K., & Shen, D. D. (1985). Circulating concentrations of di(2-ethylhexyl) phthalate and its de-esterified phthalic acid products following plasticizer exposure in patients receiving hemodialysis. *Toxicology and Applied Pharmacology, 79*(2), 257-267.

Rapley, T. (2008). Distributed decision making: The anatomy of decisions-in-action. *Sociology of Health & Illness, 30*(3), 429-444.

Reddy, B. S., Rozati, R., Reddy, B. V. R., & Raman, N. V. V. S. S. (2006). Association of phthalate esters with endometriosis in indian women. *BJOG: An International Journal of Obstetrics and Gynaecology, 113*(5), 515-520.

Rider, C. V., Wilson, V. S., Howdeshell, K. L., Hotchkiss, A. K., Furr, J. R., Lambright, C. R., & Gray, L. E. (2009). Cumulative effects of in utero administration of mixtures of "Antiandrogens" on male rat reproductive development. *Toxicologic Pathology, 37*(1), 100-113.

Robaire, B. (2009). *CIHR team in the impact of exposure to phthalates, their metabolites and "green" plasticizers on male reproductive health*. Canada.

Rose, N. S. (1999). *Powers of freedom: Reframing political thought*. Cambridge, United Kingdom; New York, NY: Cambridge University Press.

Rothman, B. K. (2000; 1989). *Recreating motherhood*. New Brunswick, NJ: Rutgers University Press.

Rouiller-Fabre, V., Lambrot, R., Muczynski, V., Coffigny, H., Lécureuil, C., Pairault, C., . . . Habert, R. (2008). Ontogenèse et régulations des fonctions testiculaires chez le fœtus humain. *Gynecologie Obstetrique & Fertilite, 36*(9), 898-907.

SÃ¡daba, C., & Schulz, W. (1997). Changes of the mass media and the public sphere. *Javnost-the Public, 4*(2)

Samandar, E., Silva, M. J., Reidy, J. A., Needham, L. L., & Calafat, A. M. (2009). Temporal stability of eight phthalate metabolites and their glucuronide conjugates in human urine. *Environmental Research, 109*(5), 641-646.

Schug, T. T., Janesick, A., Blumberg, B., & Heindel, J. J. (2011). Endocrine disrupting chemicals and disease susceptibility. *The Journal of Steroid Biochemistry and Molecular Biology, 127*(3–5), 204-215.

Scott, H. M., Hutchison, G. R., Jobling, M. S., McKinnell, C., Drake, A. J., & Sharpe, R. M. (2008). Relationship between androgen action in the "Male programming window," fetal sertoli cell number, and adult testis size in the rat. *Endocrinology, 149*(10), 5280-5287.

Searle, J. (1996). Fearing the worst: Why do pregnant women feel at risk? *Australian & New Zealand Journal of Obstetrics & Gynaecology, 36*(3)

Sharpe, R. M. (2003). The 'oestrogen hypothesis'– where do we stand now?. *International Journal of Andrology, 26*(1), 2-15.

Shaxson, L. (2009). Structuring policy problems for plastics, the environment and human health: Reflections from the UK. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*(1526), 2141-2151.

Sherwin, S. (1998). A relational approach to autonomy in health care

. In Sherwin Susan, & Feminist Health Care Ethics Research Network (Eds.), (pp. 19-47). Philadelphia: Temple University Press.

Silva, M. J., Kato, K., Wolf, C., Samandar, E., Silva, S. S., Gray, E. L., . . . Calafat, A. M. (2006). Urinary biomarkers of di-isononyl phthalate in rats. *Toxicology, 223*(1-2), 101-112.

Skakkebæk, N. E., Rajpert-De Meyts, E., & Main, K. M. (2001). Testicular dysgenesis syndrome: An increasingly common developmental disorder with environmental aspects: Opinion. *Human Reproduction, 16*(5), 972-978.

Skakkebæk, N. E., Holm, M., Hoei-Hansen, C., Jorgensen, N., & Rajpert-De Meyts, E. (2003). Association between testicular dysgenesis syndrome (TDS) and testicular neoplasia: Evidence from 20 adult patients with signs of maldevelopment of the testis. *Apmis, 111*(1), 1-11.

Society of Obstetricians and Gynaecologists of Canada. (2009). The role of obstetrician-gynaecologists canada. *Journal of Obstetrics and Gynaecology Canada, 31*(7), 666.

Stanley, M. (2006). A grounded theory of the wellbeing of older people. In L. Finlay, & C. Ballinger (Eds.), *Qualitative research for allied health professionals: Challenging choices* (pp. 63-78). England: Whurr Publishers Limited.

State of California. (2007). *AB 1108 An act to add Chapter 11 to Part 3 of Division 104 of the Health and Safety Code: Children's products: Phthalates*. 2007–2008 legislative session.

State of Maryland. (2007). *HB 833 Public Health—Phthalates and bisphenol-A—Prohibitions—Toys, child care articles, and cosmetics*.

State of Minnesota. (2008). *Chapter 301—S.F.No. 651. An act relating to health; Modifying provisions relating to maternity care; banning the use of certain phthalates, flame retardants, or other polymers or chemicals*. 85th legislative session (2007–2008).

Steinemann, A. (2004). Human exposure, health hazards, and environmental regulations. *Environmental Impact Assessment Review, 24*(7-8), 695-710.

Strauss, A. L. (1987). *Qualitative analysis for social scientists*. Cambridge Cambridgeshire; New York: Cambridge University Press.

Street, R. L., Makoul, G., Arora, N. K., & Epstein, R. M. (2009). How does communication heal? pathways linking clinician–patient communication to health outcomes. *Patient Education and Counseling, 74*(3), 295-301.

Swan, S. H. (2008). Environmental phthalate exposure in relation to reproductive outcomes and other health endpoints in humans. *Environmental Research, 108*(2), 177-184.

Swan, S., Main, K., Liu, F., Stewart, S., & al, e. (2005). Decrease in anogenital distance among male infants with prenatal phthalate exposure. *Environmental Health Perspectives, 113*(8), 1056-1056-61.

Talsness, C. E., Andrade, A. J. M., Kuriyama, S. N., Taylor, J. A., & vom Saal, F. S. (2009). Components of plastic: Experimental studies in animals and relevance for human health. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*(1526), 2079-2096.

Tansey, J., & O'riordan, T. (1999). Cultural theory and risk: A review. *Health, Risk & Society, 1*(1), 71-90.

Tardy, R. (2000). "But I am a good mom": The social construction of motherhood through health-care conversations. *Journal of Contemporary Ethnography, 29*(4), 433-473.

ter Meulen, R.H.J. (2005). The ethical basis of the precautionary principle in health care decision making. *Toxicology and Applied Pharmacology, 207*(2, Supplement), 663-667.

Tickner, J. A., & Geiser, K. (2004). The precautionary principle stimulus for solutions-and alternatives-based environmental policy. *Environmental Impact Assessment Review, 24*(7-8), 801-824.

Timmermans, S., & Angell, A. (2001). Evidence-based medicine, clinical uncertainty, and learning to doctor. *Journal of Health and Social Behavior, 42*(4), 342-342-59.

Tri-council policy statement: Ethical conduct for reserach involving humans (2010). (2nd ed.). Ottawa: Interagency Secretariat on Resarch Ethics.

Tucker Edmonds, B., Coleman, J., Armstrong, K., & Shea, J. (2011). Risk perceptions, worry, or distrust: What drives pregnant Women's decisions to accept the H1N1 vaccine? *Maternal and Child Health Journal, 15*(8), 1203-1209.

Tucker Edmonds, B., Coleman, J., Armstrong, K., & Shea, J. (2011). Risk perceptions, worry, or distrust: What drives pregnant Women's decisions to accept the H1N1 vaccine? *Maternal and Child Health Journal, 15*(8), 1203-1209.

Tyler, T. R., & Cook, F. L. (1984). The mass media and judgments of risk: Distinguishing impact on personal and societal level judgments. *Journal of Personality and Social Psychology, 47*(4), 693-708. doi:10.1037/0022-3514.47.4.693

U.S. Congress. (2008). *Public Law No. 110–314 (HR 4040). Consumer Product Safety Improvement Act of 2008*.

U.S Environmental Protection Agency. (2009). *Phthalates action plan.* Unpublished manuscript.

Wahlberg, A. A. F., & Sjoberg, L. (2000). Risk perception and the media. *Journal of Risk Research, 3*(1), 31-50. doi:10.1080/136698700376699

Walter, F. M., Emery, J., Braithwaite, D., & Marteau, T. M. (2004). Lay understanding of familial risk of common chronic diseases: A systematic review and synthesis of qualitative research. *Annals of Family Medicine, 2*(6), 583-594.

Wenner Moyer M. The New Toxic Threats to Women's Health. *Glamour Magazine* . (2011).

Whittemore, R., Chase, S., & Mandle, C. (2001). Validity in qualitative research. *Qualitative Health Research, 11*(4), 522-537.

Wikipedia. (2012). *Phthalate.* Retrieved from http://en.wikipedia.org/wiki/Phthalate

Wilson, V. S., Blystone, C. R., Hotchkiss, A. K., Rider, C. V., & Gray, L. E. (2008). Diverse mechanisms of anti-androgen action: Impact on male rat reproductive tract development. *International Journal of Andrology, 31*(2), 178-187.

Wollstonecraft, M. (2004). *A vindication of the rights of woman* (Rev ed.). London; New York: Penguin Books.

Yanagisawa, R., Takano, H., Inoue, K., Koike, E., Sadakane, K., & Ichinose, T. (2008). Effects of maternal exposure to di-(2-ethylhexyl) phthalate during fetal and/or neonatal periods on atopic dermatitis in male offspring. *Environmental Health Perspectives, 116*(9), 1136-1136-41.

Zelezny, L. C., Chua, P., & Aldrich, C. (2000). New ways of thinking about environmentalism: Elaborating on gender differences in environmentalism. *Journal of Social Issues, 56*(3), 443-457.

Zhang, Y. H., Zheng, L. X., & Chen, B. H. (2006). Phthalate exposure and human semen quality in shanghai: A cross-sectional study. *Biomedical and Environment Science, 66*, 105-116.

Zhu, Y., Jiang, J., Ma, L., Zhang, J., Hong, Y., Liao, K., . . . Liu, G. (2009). Molecular and toxicologic research in newborn hypospadiac male rats following in utero exposure to di-n-butyl phthalate (DBP). *Toxicology, 260*(1-3), 120-125.

Zikmund-Fisher, B. J., Fagerlin, A., Keeton, K., & Ubel, P. A. (2007). Does labeling prenatal screening test results as negative or positive affect a woman's responses? *American Journal of Obstetrics and Gynecology, 197*(5), 528-e6.

Appendix A. *List of Abbreviations*

ACC: American Chemistry Council
AGD: Anogenital distance
BBP: Butyl benzyl phthalate
BPA: Bisphenol A
CBC: The Canadian Broadcasting Company
CDC: Center for Disease Control and Prevention
CEPA: Canadian Environmental Protection Act
CFPC: The College of Family Physicians Canada
CNN: The Cable News Network
DBP: Dibutyl phthalate
DDT: dicholorodiphenylthrichloroethane
DEHP: Di(2-ethylhexyl) phthalate
DIBP: Diisobutyl phthalate
DIDP: 1,2-diisodecyl ester
DINP: Diisononyl phthalate
DnPP: Di-*n*-pently phthalate
ECPI: European Council for Plasticisers and Intermediates
EPA: United States Environmental Protection Agency
EU: European Union
FP: Family Physician
Gov: Government
GPs: General Practitioners
INSL3: Insulin-like hormone 3
Manftr: Manufacturers
MBP: Mono-butyl phthalate
MW: Midwife
OB: Obstetrician
PCBs: Polychlorinated biphenyls
PVC: Polyvinyl chloride
PW: Pregnant Woman
REACH Program: European Union's Registration, Evaluation, Authorisation and Restriction of Chemical Substances program
SOGC: Society of Obstetricians and Gynaecologists
TDS: Testicular Dysgenesis Syndrome

Appendix B. *Glossary of Terms*

Agenesis: Impaired organ development

Anemia: Deficiency of red blood cells

Anogenital Distance: The region between the scrotum and the anus in males, and between the posterior vulva junction and the anus in females.

Anti-Androgens: Any class of drugs that oppose the action of androgens

Biomonitoring: The measurement of the body burden of toxic chemical compounds, elements, or their metabolites, in biological substances.

Body Burdens: Levels of man-made chemicals and their metabolites in a human system

Constructivism: Research position that rejects the idea of an objective, ontological reality. Instead, constructivism posits that reality is constantly constructed through social interaction, dialogue and action.

Critical Theory: Research position that assumes reality is structured, often incorrectly, by historical trends that can be revealed through value-mediated processes

Cryptorchidism: A condition defined by undescended testes

Dicholorodiphenylthrichloroethane: A banned fertilizer

Eczema: A medical condition in which patches of skin become rough and inflamed, with itching and bleeding blisters

Endocrine Disruptors: "Synthetic chemicals that were originally designed for a specific action such as a pesticide, plasticizer, or solvent, but now have been found to have a side effect that when absorbed into the body causes them to either mimic or block hormones and disrupt the body's normal functions. This disruption can occur by altering normal hormone levels, inhibiting or stimulating the production and metabolism of hormones, or changing the way hormones travel through the body, thus affecting the functions that these hormones control (pp. 204-205)." (Schug, Janesick, Blumberk, & Heindel, 2011)

Endometriosis: Inflammation of the uterus

EPA Reference Dose: A figure estimating the maximum daily exposure of a chemical or toxicant considered to be safe

Epididymis: A highly convoluted duct behind the testis, along which sperm passes to the vas deferens.

EU Tolerable Daily Intake: A figure estimating the maximum daily exposure of a chemical or toxicant considered to be safe

Gubernaculum: Cord stretching from epididymis to scrotal sac and supports the testis

Historical Realism: An apprehendable reality that was once plastic but has now been solidified due to historical, political, and social processes

Heuristics: Cognitive shortcuts used to quickly evaluate risks

Hypospadias: Abnormal urethral opening

Leydig Cells: Cells found in the testes responsible for releasing sex hormones

Leutenizing Hormone: A hormone secreted by the anterior pituitary gland that stimulates ovulation in females and the synthesis of androgen in males.

Medicalization: "Medicalization describes a process by which nonmedical problems become defined and treated as medical problems, usually in terms of illnesses or disorders (pp. 209)." (Conrad, 1992)

Metabolite: Any chemical compound involved in, or a product of, metabolism.

Monomer: Molecule that is the repeating unit of a polymer

Phthalates: Diesters of 1,2-benzenedicarboxylic phthalic acid that are used in a wide range of commercial and household products such as insulation, polyvinyl chloride, children's toys, food containers, time-released pharmaceuticals, and personal care products

Plasticizer: Chemical additives in plastic that impart a wide range of effects including strength, softening, flame retarding, and degradation prevention.

Polybrominated Diphenyl Ether: Flame retarding plasticizer

Polymer: Large organic molecule made up of subunits covalently linked together

Preeclampsia: High blood pressure due to pregnancy

Prostate: A gland in the male reproductive system

Relativist Ontology: The assumption that reality is context dependent and locally constructed

Subjective Epistemology: The assumption that knowledge is co-created amongst individuals

Testicular Dysgenesis Syndrome: A condition that describes male fetuses that fail to develop normal testis in utero

Testosterone: Main male sex hormone in mammals

Thelarche: Breast development

Toxemia: Blood poisoning due to a local bacterial infection

Wolffian Duct: A pair of ducts developing in the early mammalian embryo which will give rise to the internal sex organs in males

Appendix C. *Recruitment Poster*

Pregnant Women

You are invited to participate in a study examining the issues related to exposure to household chemicals during pregnancy. We hope you will consider being interviewed for 30-45 minutes. You will be reimbursed for any expenses.

If you would like to participate or for more information, please call [redacted]

This research project is funded by the Canadian Institute of Health Research and is being conducted by the Department of Obstetrics & Gynaecology at the Schulich School of Medicine & Dentistry, at The University of Western Ontario.

Appendix D. *Information Pamphlet*

Background

re interested in hearing your
s on what you would like to
about household chemicals
ile you are pregnant. For
mple, a group of chemicals
n as plasticizers are used to
e plastics flexible. They are
n floor tiles, clothes, medical
es, toys, food packaging, and
sonal care products. These
pounds have been shown to
out of various products, and
also present in appreciable
ounts in our environment.

ese types of chemicals have
ly been identified as endocrine-
upting compounds. These are
pounds that mimic naturally
urring hormones in the body,
ring with the endocrine system
oduce adverse developmental
eproductive effects. However,
ull range and extent of these
s have not yet been icentified.

Objectives of this Study

To discuss the issues surrounding exposure to everyday household chemicals in pregnancy with pregnant women and obstetrical care providers.

Issues include:

Current level of knowledge of chemical exposures

What further information should be provided to patients and their families.

Who is responsible for conducting further research and disseminating information regarding potential health risks of chronic exposure to these products.

Who Can Participa

If you are pregnant and over the
or are an obstetrical care pro
(Obstetrician, Family Physician,
Midwife), we invite you to part

Details of Participat

You will be asked to spend 20-30
participate in an interview. You
reimbursed for any travel exp

Appendix E. *Information and Consent Form*

INFORMATION AND CONSENT FORM

Investigation Title: Exploration of the Ethical, Legal and Social (ELS) Issues Related to Environmental Exposures to Chemicals in Household and Consumer Products and Impacts on Reproductive Health

Principal Investigator: Dr. Jeff Nisker

Sponsor: **Canadian Institutes of Health Research**

Introduction:

You are invited to participate in research studying environmental exposures to chemicals in household and consumer products. Low-doses of some of these substances are increasingly being suspected to cause health problems in humans. The chemicals known as phthalates are the subject of our study.

Phthalates are used in a variety of consumer products in order to make hard plastics more flexible. They are also used as fragrance carriers in personal care products including creams, lotions, perfumes, etc. Phthalates can be absorbed through the skin, inhaled or ingested.

What is the purpose of this study?
The purpose of this study is to investigate pregnant women and clinical care providers' attitudes and knowledge towards reproductive exposures to environmental toxins in household and consumer products.

How many people will take part in the study?
Approximately 25 pregnant women and 25 clinical care providers (Obstetricians, Midwives and Nurses) over 18 years of age will be recruited for this research.

Explanation of the investigation procedures:
If you agree to participate, you will be asked to sign a consent form, provide and complete our guided research questionnaire. It takes approximately 30-45 minutes to complete and will be audio-taped and transcribed for data analysis.

Compensation:
You will receive financial compensation for any travel expenses incurred.

Benefits:
Other than the compensation for travel expenses, there will not be any direct benefits to you as a result of agreeing to participate in this study.

Subject rights:
You have the right to ask as many questions about this study as you wish at any time. You are free not to participate. If you decide to participate, you are free not to participate in any part of study you wish or not to answer any of the questions put to you. You have the right to withdraw from the study at any time.

A copy of this consent form will be given to you to keep. Its purpose is to give you a basic idea of what the study is about and what participation in the study will involve. If you have any questions about the research study, would like to be given more details about something mentioned here or information not included, you should feel free to ask the interviewer.

Confidentiality:
All information collected in this study, whether personal or research-related, will be treated confidentially. All information will be coded and your code interface will be kept at the London Health Sciences Centre in a locked cabinet under the responsibility of Dr. Jeff Nisker. All coded data will be kept in a locked cabinet or password protected computer at the London Health Sciences Centre. If applicable, the results of this study may be published or communicated in other ways, but it will be impossible to identify you.

Unless you have provided specific authorization or where the law permits or a court order has been obtained, the information you provide will not be made available to third parties such as employers, governmental organizations, insurance companies or educational institutions. This also applies to your spouse, other members of your family and your physician.

However, for the purposes of ensuring the proper management of the research, it is possible that a member of the Research Ethics Board, an ethics committee or a Health Canada representative may consult your coded research data. For quality assurance and data analysis, personnel from the following organizations may have access to your coded research records for auditing purposes: a regulatory agency, the Research Ethics Board or other agencies whose job is to supervise research studies such as this one. The auditors will be bound by the same rules of confidentiality as the researchers.

Communication of results:
You can communicate with the research team to obtain information on the status of the work or the general results of the research project. While we do not expect this to be the case, you will be informed of any information that may affect your health.

Subject consent:

- I have read this informed consent and am in agreement that the questionnaire data can be used for this research. I understand that my participation is voluntary.
- I have familiarized myself with the consent form. All my questions regarding participation in this research study have been answered. I agree to participate in this research project.
- By signing this form I have not waived any of my legal rights.
- I understand that I will receive a copy of this signed and dated consent form.

_____
Subject Name (print)

_____ _____
Subject Signature Date

Person conducting the informed consent process including administration and explanation of the form

_____ _____
Signature Printed name

_____
Date

Approved by the University of Western Ontario Review Board
Date: September 15, 2010

Appendix F. *Interview Prompts*

1. What does risk in pregnancy mean to you?
2. Do you think environmental exposures impact your health?
   a. Do you think these exposures could impact the health of your fetus?
   b. Do you think there are items in your household that pose a risk to your health or the health of your fetus?
   c. Do you think there are items in your workplace that pose risk to your health or the health of your fetus?
3. Tell me about your access to resources throughout the pregnancy.
   a. Do you think any of these resources have been more impactful than others?
   b. Do you think access to resources from other sources would have been beneficial to you?
   c. Where would you go if you had additional questions or required additional information pertaining to your pregnancy or your health?
4. Have you heard about Phthalates?
   a. Do these chemicals or others like them impact your daily life?

   **Provide patient with information
5. Now knowing what you know about Phthalates, is there additional information that you think would be important to know?
6. Are there steps you think you can take to control your exposure to Phthalates?
7. What is the role/responsibility, if any, of your obstetrical care provider when it comes to your health and the health of your fetus?
   a. Is there anyone else you think is responsible for your health and the health of your fetus?
8. Is there a point at which you think various parties should be providing you or the general public with information regarding potential risk? Why? Please expand.
9. If you knew about Phthalates what you know about other risks in pregnancy, would it change:
   a. What you purchase?
   b. What items you have in your home and/or workplace?
   c. Your everyday behaviours?

Appendix G. *Ethics Approval*

Research Western

Use of Human Participants - Ethics Approval Notice

Principal Investigator: Dr. Jeff Nisker
File Number: 7328
Review Level: Delegated
Approved Local Adult Participants: 80
Approved Local Minor Participants: 0
Protocol Title: Exploration of the Ethical, Legal and Social (ELS) Issues Related to Environmental Exposures to Chemicals in Household and Consumer Products and Impacts on Reproductive Health - 17405E
Department & Institution: Schulich School of Medicine and Dentistry\Obstetrics & Gynaecology,London Health Sciences Centre
Sponsor: Canadian Institutes of Health Research

Ethics Approval Date: May 24, 2012 Expiry Date: September 30, 2015
Documents Reviewed & Approved & Documents Received for Information:

Document Name	Comments	Version Date
Revised Western University Protocol	Recruitment has been expanded to conducting interviews with chemical engineers and scientists who are members of the CIHR team grant as well as government and industry representatives.	
Revised Letter of Information & Consent		2012/05/01
Other	Email Recruitment	
Other	Interview Prompts	

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the University of Western Ontario Updated Approval Request Form.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

The Chair of the HSREB is Dr. Joseph Gilbert. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

[redacted]
Signature

Ethics Officer to Contact for Further Information

Janice Sutherland	Grace Kelly	Shantel Walcott
[redacted]	[redacted]	[redacted]

This is an official document. Please retain the original in your files.

The University *of* Western Ontario

[redacted]

CURRICULUM VITAE

Name:	Justin Ashley
Post-secondary Education and Degrees:	University of Western Ontario London, Ontario, Canada 2006-2010 B.HSc.
Honours and Awards:	Student Abstract Award Winner Canadian Bioethics Society 2011 Annual Meeting 2011 Western Graduate Research Scholarship, Rehabilitation Sciences The University of Western Ontario 2010-2011, 2011-2012 University of Western Ontario, Dean's Honor List 2008-2010 Western Scholarship of Distinction The University of Western Ontario 2006-2007
Related Work Experience	Research Assistant The University of Western Ontario 2010-Present

Publications:

How Pregnant Women Navigate Risk Information in Pregnancy (in preparation)
Hodgson A, Ashley J, Nisker J

Pregnant Women, Phthalates and Relational Autonomy (in preparation)
Ashley J, Sharma S, Nisker J

Views of pregnant women and obstetrical care providers regarding risk of phthalates during pregnancy (in preparation)
Sharma S, Ashley J, Nisker J